Appendix F: Air Quality Technical Assessment

The definition of acronyms used in this Appendix are:

AAQS Ambient Air Quality Standards APCD Air Quality Control Division

AP-42 EPA's compilation of emission factors

AQRV Air Quality Related Values

BART Best Available Retrofit Technology

BTEX Benzene, toluene, ethylbenzene, and xylenes CAAQS Colorado Ambient Air Quality Standards CAFO Concentrated animal feeding operation

CAMx Comprehensive Air Quality Model with Extensions

CH4 Methane

CO Carbon monoxide CO2 Carbon dioxide

CO2e Carbon dioxide equivalent

km Kilometer

μg/m3 Micrograms per cubic meterMMscf Million standard cubic feet

mtpy Metric tons per year

N NitrogenN2O Nitrous oxideNO2 Nitrogen dioxideNOx Oxides of nitrogen

NAAOS National Ambient Air Quality Standards

PM Particulate matter

PM2.5 Particulate matter less than or equal to 2.5 microns in diameter PM10 Particulate matter with aerodynamic diameter of 10 microns or less

ppb Parts per billion ppm Parts per million

PSD Prevention of Significant Deterioration

S Sulfur

SO2 Sulfur dioxide

tpy Tons per year (short)

Introduction

This air quality appendix provides an outline of the techniques that were employed in the environmental analysis process, and planning process, for the Kremmling Field Office (KFO). The PRMP/FEIS addresses future land and resource management options, and the potential environmental impacts that may result from each of those options, for approximately 377,900 surface acres and approximately 653,500 subsurface acres of mineral estate administered by the KFO in Jackson, Grand, and Summit counties in their entirety, and in portions of Eagle, Larimer and Routt Counties, Colorado. This combined acreage (surface acres and subsurface mineral estate) is being analyzed as the "Decision Area" for the purposes of this PRMP/FEIS. The "Planning Area" comprises all land ownerships in these counties within the boundaries of the Kremmling Field Office, totaling about 3.1 million surface acres and 2.2 million acres of federal mineral estate. Under the PRMP/FEIS, approximately 91 percent of the Federal mineral estate in the Decision Area is available for oil and gas leasing. Approximately 27 percent of federal mineral estate in the Decision Area is leased for oil and gas.

Approximately 675 wells have been drilled in the Planning Areas since the early 1920s. Averaged over the past 90 years, this is approximately 7 to 8 wells per year. After internal and external scoping was conducted during the planning process, it was determined that a qualitative assessment for air resource impacts was appropriate for most management activities proposed in the DRMP/DEIS. A quantitative Emissions Inventory was developed to analyze the potential emissions associated with oil and gas activities and livestock grazing. Due to the relatively low level of fluid minerals development, and to the highly speculative nature of currently available data, including the lack of well location data, the BLM determined that a hypothetical Air Quality Modeling Assessment for the DRMP/DEIS would not provide useful, or accurate, predictive information for the public or for the decision-maker. When adequate data becomes available, such as during the project application stage, it may become necessary to require air quality modeling in order to assess the potential impacts during the National Environmental Policy Act (NEPA) environmental analysis process for future activities prior to authorization by the BLM.

Historically, there has been relatively little oil or gas development in the Planning Area; the underground geology of the area is not well understood. If, or when, exploration wells are drilled, more information will be known about the location, quality, and characteristics of the resources. The KFO has a Reasonably Foreseeable Development (RFD) Scenario that discusses the potential of up to 370 oil and gas wells (192 wells on Federal lands and 178 wells on fee lands) to be drilled over the next 20 years (BLM 2008r). The BLM determined that the preparation of an Emission Inventory would be the most appropriate assessment for air quality at this time. Detailed information is either unknown, or too speculative, to conduct a quantitative air quality impacts analysis (a Modeling Analysis). If, or when, activities are proposed for implementation under the Approved RMP (Approved Plan), and if air quality is

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determined to be an issue of concern during the environmental analysis process, a more detailed air quality analysis will be conducted, including, potentially, a more detailed Emissions Inventory or a Modeling Assessment. See Appendix X, Air Quality Management Plan for related information.

The BLM – Colorado is currently conducting a Colorado-wide oil and gas modeling study (CARMMS) that will include analyses for each BLM Field Office including the KFO. For this Study, oil and gas emissions increases projected out 10 years from year 2011 according to RFD and recent oil and gas development data will be modeled and impacts will be determined for each Field Office. Regional ozone and other pollutants and air quality related values (AQRVs) including visibility impacts will be evaluated in that Study. The Study should be completed in spring 2014. As future oil and gas development occurs in the KFO, the BLM Colorado plans to compare project-specific permitted levels of emissions to the KFO oil and gas emissions rates modeled in the regional study along with the corresponding modeling results to ensure that the BLM Colorado is permitting activities that stay within the acceptable modeled emissions analyzed in the cumulative air quality impacts study.

Air Quality Management Framework

The basic framework for controlling air pollutants in the United States is mandated by the Clean Air Act (CAA), and its amendments, and by State air quality management programs. Federal and State air quality management programs have evolved using two distinct management approaches:

- State Implementation Plan -- The first type of management approach is the State Implementation Plan (SIP) process of setting ambient air quality standards for acceptable exposure to air pollutants; conducting monitoring programs in order to identify locations experiencing air quality problems; and developing programs and regulations designed to reduce, or eliminate, those problems.
- Hazardous Air Pollutants -- The second type of management approach involves the Hazardous Air Pollutant (HAP) regulatory process, which identifies specific chemical substances that are potentially hazardous to human health, and then sets emission standards in order to regulate the amount of those substances that can be released by individual commercial or industrial facilities, or by specific types of equipment.

Air quality programs based upon ambient air quality standards typically address air pollutants that are produced in large quantities by widespread types of emission sources, and that are of public health concern. In addition to pollutants for which there are adopted ambient standards, the SIP planning process is also used in order to address regional haze visibility issues. The industry-specific emission regulation approach is used currently to address air quality concerns of hazardous air pollutants and some ozone-depleting chemicals.

For the BLM, air quality and climate are the principle components of the BLM Air Resource Management Program. The program focuses on management of air resources, as well as on how they affect, and are affected by, other resource values and uses of the public lands.

Air quality is determined by the composition (chemical and physical) and concentration of atmospheric pollutants, meteorology, and terrain; it also includes noise considerations, smoke management, and visibility. The CAA currently identifies six nationally regulated air pollutants (called criteria pollutants) and 187 hazardous air pollutants, subject to change over time. For more information, visit: http://www.epa.gov/ttn/atw/pollsour.html. Activities, programs, and projects initiated by the BLM, as well as activities and projects initiated by external proponents, have the potential to impact air quality by emissions of these pollutants. The BLM analyzes the potential impacts of all Proposed Actions on air quality as part of its planning, environmental analysis, and decision-making processes.

Climate represents the long-term statistics of daily, seasonal, and annual weather conditions. Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years (typically, 30 years). Climate is both a driving force and a limiting factor for biological, ecological, and hydrologic processes, and for resource management activities such as disturbed-site reclamation, wildland fire management, drought management, rangeland and watershed management, and wildlife habitat administration.

The BLM is responsible for ensuring that the activities, programs, and projects it undertakes or authorizes comply with all applicable laws, rules, regulations, policies, standards, and guidelines; including establishing conditions of approval (COAs) and stipulations in leases and permits. Under the Federal Land Policy and Management Act (FLPMA), the BLM is responsible for developing RMPs that provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards or implementation plans; and to manage the public lands in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values. In addition, RMPs may also establish management goals and objectives for BLM-managed public lands, and their associated resources, which require managing activities in a manner designed to attain, or maintain, a higher standard of air quality than that required by the CAA.

Criteria Pollutants

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six different pollutants, called criteria pollutants. Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), ozone (O₃), particulate matter (PM₁₀, PM_{2.5}), and lead (Pb). Federal ambient air quality standards are primarily based upon evidence of acute and chronic health effects that apply to outdoor locations to which the general public has access. The criteria pollutants are:

- Carbon Monoxide -- Carbon monoxide is a colorless, odorless gas formed during incomplete combustion of organic compounds. The major sources of carbon monoxide are combustion processes, such as fuel combustion in motor vehicles and industrial processes, agricultural burning, prescribed burning, and wildfires. Carbon monoxide is a public health concern because it combines readily with hemoglobin in the blood, and, as a result, reduces the amount of oxygen transported to body tissues. Relatively low concentrations of carbon monoxide can significantly affect the amount of oxygen in the blood stream because carbon monoxide binds to hemoglobin 200 times to 250 times more strongly than does oxygen. The cardiovascular system and the central nervous system can be affected when 2.5 percent to 4.0 percent of the hemoglobin in the blood is bound to carbon monoxide rather than to oxygen. Usually, due to its low chemical reactivity and low solubility, indoor carbon monoxide levels are similar to outdoor levels.
- **Nitrogen Dioxide --** Nitrogen dioxide is a brownish red gas formed as an indirect product of combustion processes. Some nitrogen dioxide can be formed from nitrogen compounds contained in the combusted fuel; however, most is produced by high-temperature oxidation of nitrogen gas in the air. The dominant oxide of nitrogen produced during combustion is nitric oxide. Nitric oxide is converted fairly quickly into nitrogen dioxide by chemical reactions with atmospheric oxygen and ozone. Nitrogen dioxide is a respiratory and eye irritant, as well as a plant toxin. Nitrogen dioxide is also a precursor of photochemically generated ozone, nitric acid, and nitrate aerosols.
- **Sulfur Dioxide** -- Sulfur dioxide is a colorless, but pungent, gas formed primarily by combustion of sulfur-containing compounds. Sulfur dioxide is a respiratory irritant, and undergoes chemical reactions that can form sulfuric acid and various sulfate aerosols.
- Ozone -- Ozone is not released directly into the atmosphere. It forms as the result of complex chemical reactions that occur in sunlight. The chemical reactions that produce ozone involve a wide range of volatile organic compounds (VOCs) and oxides of nitrogen. VOCs and nitrogen oxides (the combination of nitric oxide and nitrogen dioxide) are the precursor emission products that form ozone. The atmospheric chemical reaction processes that produce ozone also produce chemically formed particulate matter and acidic compounds. Combustion processes, which produce nitrogen oxides, and evaporation of VOCs, are the major emission sources for organic compounds. Common combustion sources include: fuel combustion in motor vehicles; fuel combustion in industrial processes; agricultural burning; prescribed burning; and wildfires. Common

evaporative sources of organic compounds include paints, solvents, liquid fuels, or liquid chemicals. Ozone is a strong oxidizing agent that reacts with a wide range of materials and biological tissues. It is a respiratory irritant that can result in acute and chronic impacts to the respiratory system. Recognized impacts include: reduced pulmonary function; pulmonary inflammation; increased airway reactivity; aggravation of existing respiratory diseases such as asthma, bronchitis, and emphysema; physical damage to lung tissue; decreased exercise performance; and increased susceptibility to respiratory infections. In addition, ozone is a necrotic agent that significantly damages leaf tissues of crops and natural vegetation. Ozone also damages many materials by acting as a chemical oxidizing agent. Usually, due to its photochemical activity, indoor ozone levels are much lower than outdoor levels.

• Particulate Matter -- The major emission source categories for suspended particulate matter include: combustion sources, such as fuel combustion in motor vehicles and industrial processes, agricultural burning, prescribed burning, and wildfires; aerosols; industrial grinding and abrasion processes; soil disturbance by construction, agricultural and forestry equipment, recreational vehicles, or other vehicles and equipment; mining and other mineral extraction activities; and wind erosion resulting from exposed soils and sediments. Suspended particulate matter is also formed by atmospheric chemical reactions.

Suspended particulate matter represents a diverse mixture of solid and liquid material having size, shape, and density characteristics that allow the material to remain suspended in the air for meaningful time periods. The physical and chemical composition of suspended particulate matter is highly variable, resulting in a wide range of public health concerns. Many components of suspended particulate matter are respiratory irritants. Some components, such as crystalline or fibrous minerals, are primarily physical irritants. Other components are chemical irritants, such as sulfates, nitrates, and various organic chemicals. Suspended particulate matter also can contain compounds, such as heavy metals and various organic compounds that are systemic toxins or necrotic agents. Suspended particulate matter or compounds adsorbed on the surface of particles can also be carcinogenic or mutagenic chemicals. Public health concerns associated with suspended particulate matter focus on the particle size ranges likely to reach the lower respiratory tract or the lungs. Inhalable particulate matter (PM₁₀) represents particle size categories that are likely to reach either the lower respiratory tract or the lungs after being inhaled. Fine particulate matter (PM_{2.5}) represents particle size categories likely to penetrate to the lungs after being inhaled. (The "10" in PM₁₀ and the "2.5" in PM_{2.5} are not upper size limits. The numbers refer to the particle size range collected with 50 percent mass efficiency by certified sampling devices; larger particles are collected with lower efficiencies, and smaller particles are collected with higher efficiencies.)

In addition to public health impacts, suspended particulate matter results in a variety of material damage and nuisance impacts, including abrasion; corrosion, pitting, and other chemical reactions on material surfaces; soiling; and transportation hazards due to visibility impairment.

Lead -- Lead is a toxic metal that can cause learning disabilities and damage to the
kidneys and brain. Atmospheric lead compounds occur, primarily, as a component of
suspended particulate matter. Since the phase-out of lead additives in most gasoline, the
dominant source of lead in atmospheric particles in the United States has become
industrial facilities, such as lead smelters, and dust from deteriorating lead-based paints.

Colorado and National Ambient Air Quality Standards

Colorado has adopted State ambient air quality standards that are, generally, equal to current or former Federal standards. Colorado has adopted a 3-hour sulfur dioxide standard that is more stringent than the comparable Federal standard. Table F-2.1, Colorado and National Ambient Air Quality Standards, summarizes current Federal and Colorado ambient air quality standards. (*NOTE: Since this table was created, the EPA has promulgated some additional standards: an additional 1-hour standard for NO*₂, which is 189 ug/m³; an additional 1-hour standard for SO₂, which is 196 ug/m³; also, the PM_{2.5} annual standard is now 12 ug/m³.)

Air pollutants covered by State and Federal ambient air quality standards can be categorized by the nature of their toxic effects, such as:

- irritants, such as ozone, particulate matter, nitrogen dioxide, sulfur dioxide, sulfate particles, and hydrogen sulfide, that affect the respiratory system, eyes, mucous membranes, and the skin;
- asphyxiants, such as carbon monoxide and nitric oxide, that displace oxygen or interfere
 with oxygen transfer in the circulatory system, thereby affecting the cardiovascular and
 central nervous system;
- necrotic agents, such as ozone, nitrogen dioxide, and sulfur dioxide, that directly cause cell death; or
- systemic poisons, such as lead particles, that affect a range of tissues, organs, and metabolic processes.

Table F-2.1 National Ambient Air Quality Standards (NAAQS), Colorado Ambient Air Quality Standards (CAAQS), and PSD Significant Monitoring Concentrations

Criteria Pollutant	Avg. Period	Primary Standard (μg/m ³ [ppm/ppb])	Secondary Standar	Addition al Standsar ds	PSD Significant Monitoring Concentration		
		NAAQS	NAAQS	CAAQS			
со	l-hour	40,000 [35ppm]	None	NA	NA		
со	8-hour	10,000 [9ppm]	None	NA	575 ug/m³		
NO ₂	l-hour	189 [100ppb]	NA	NA	NA		
NO ₂	Annual	100 [53ppb]	100 [53ppb]	NA	14 ug/m3		
PM_{10}	24-hour	150	150	NA	10 ug/m3		
PM _{2.5}	24-hour	35	35	NA	4 ug/m3		
PM _{2.5}	Annual	15	15	NA	NA		
SO ₂ °	l-hour	196 [75ppb]	NA	NA	NA		
SO ₂ ^f	3-hour	NA	1300 [.5ppm]	700 ug/m3	NA		
SO ₂ ⁸	24-hour	NA	NA	NA	13 ug/m3		
SO ₂ ⁸	Annual	80 [0.030]	NA	NA	NA		
Ozone	8-hour	.075 ppm	.075 ppm	NA	100 tpy VOCs or Nox		

Lead	rolling 3-month	.15 ug/m3	.15 ug/m3	NA	NA
Lead	3-month	NA	NA	NA	.1 ug/m3
Fluorides	24-hour	NA	NA	NA	.25 ug/m3
Total Reduced Sulfur	1-hour	NA	NA	NA	.2 ug/m3
Reduced Sulfur Compounds	l-hour	NA	NA	Na	10 UG/M3

^{**}The significant monitoring concentrations (de minimis levels) apply only to new sources and modifications subject to PSD review (see Regulation No. 3, Part D, section VI.)

CAAQS = Colorado Ambient Air Quality Standards

 $\mu g/m^3 = micrograms per cubic meter$

N/A = not applicable

NAAQS = National Ambient Air Quality Standards

For short-term (non-annual) averaging times, compliance with the CO, PM₁₀, and SO₂ NAAQS is based on the highest-second-highest (H2H) short-term concentration, while compliance with the short-term PM₂₅ and NO₂ NAAQS is based on the highest 3-year average eighth-highest short-term concentration. Short-term modeled concentrations reported here are highest-second-highest for CO, PM₁₀, and SO₂, and highest-eighth-highest for PM₂₅ and NO₂. Annual (long-term) modeled concentrations are highest concentrations which are required for an annual average NAAQS compliance demonstration.

b The 1-hour NO₂ background concentration was not added to the modeled concentration. February 22, 2010 USEPA guidance describes identification of the 3-year average of the eighth-highest modeled concentration on a receptor-by-receptor basis (USEPA 2010c). Inclusion of background concentration is not included in the procedure for comparing AERMOD modeling results with the 1-hour NO₂ NAAQS.

⁶ PM_{2.5} and PM₁₀ modeling results are shown for Alternatives B, C, and D fugitive dust emission rates (which are identical) and for Alternative A non-fugitive dust emission rates.

^d Due to 1-hour NO₂, 24-hour PM_{2.5}, and 1-hour SO₂ NAAQS standard formats that use a three-year average to determine compliance, only one total concentration is reported for the three-year modeling period.

⁶ The new 1-hour SO_2 standard became effective on August 23, 2010. To comply with the 1-hour SO_2 standard, the three-year average of the annual 99th percentile of the 1-hour daily maximum concentration must be less than or equal to 195.5 $\mu g/m^3$ (75 ppb).

^f As of August 23, 2010, this standard transitioned from a primary standard (protecting human health) to a secondary standard (protecting environment) at the federal level. However, state air quality agencies have discretion to continue enforcing this standard as a primary standard. The 3-hour standard will become obsolete at the federal level once attainment/nonattainment designations under the new 1-hour SO₂ standard are promulgated by USEPA.

⁸ The 24-hour and annual standard will become obsolete at the federal level once attainment/nonattainment designations under the new 1-hour SO₂ standard are promulgated by USEPA.

Hazardous Air Pollutants

Air quality programs based upon the regulation of other hazardous substances typically address chemicals used, or produced, by limited categories of industrial facilities. Programs regulating hazardous air pollutants focus on substances that alter or damage the genes and chromosomes in cells (mutagens); substances that affect cells in ways that can lead to uncontrolled cancerous cell growth (carcinogens); substances that can cause birth defects or other developmental abnormalities (teratogens); substances with serious acute toxicity effects; and substances that undergo radioactive decay processes (resulting in the release of ionizing radiation). Federal air quality management programs for hazardous air pollutants focus on setting emission limits for particular industrial processes rather than on setting ambient exposure standards. Federal emission standards for hazardous air pollutants have been promulgated as National Emission Standards for Hazardous Air Pollutants (NESHAP) and as Maximum Achievable Control Technology (MACT) standards. The Federal MACT standard for mercury emissions from coal-fired power plants represents an example of such hazardous air pollutant control programs. The NESHAP and MACT standards are implemented through State and Federal air quality permit programs. Colorado Air Pollution Control Division (APCD) Regulation 8 adopts Federal NESHAP and MACT standards by reference, and includes additional requirements for the State asbestos control program.

Visibility Impairment

The EPA, the BLM, the US Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), and regional associations of State Air Quality Management Agencies operate the Inter-agency Monitoring of Protected Environments (IMPROVE) program. The IMPROVE program monitors visibility conditions and particulate matter concentrations in, or near, Class I Areas across the country. Some of the IMPROVE sites also document visibility conditions with remotely operated cameras. There are six IMPROVE monitoring locations in Colorado; three of which are in, or near, the Planning Area. The NPS operates one Monitoring Station on the east side of Rocky Mountain National Park. The USFS operates one Monitoring Station at Buffalo Pass (south end of the Mount Zirkel Wilderness), and one Monitoring Station at the Aspen Mountain Ski Area (east of the Maroon Bells-Snowmass Wilderness).

Atmospheric Deposition Constituents

Two separate Air Quality Monitoring Programs are being used to monitor atmospheric deposition of various compounds. The Programs originated as acid deposition monitoring programs, but they have expanded to include monitoring of other compounds. The EPA Clean Air Status and Trends Network (CASTNET) operates as a dry deposition monitoring program. There are three CASTNET monitoring sites in Colorado: Rocky Mountain National Park, Gothic, and Mesa Verde National Park. The CASTNET monitoring site in Rocky Mountain National Park is not co-located with the IMPROVE site in the Park. The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) program provides wet deposition monitoring focused on acid deposition issues. A mercury deposition monitoring program was integrated into the NADP/NTN program in 1996, although it does not operate at all NADP/NTN sites. Nationally, there are more than 250 sites in the NADP/NTN network, with 19 sites in Colorado. Some of the NADP/NTN sites are either colocated, or located near, CASTNET or IMPROVE monitoring sites.

Greenhouse Gases

Greenhouse gases (GHGs) are compounds in the atmosphere that absorb infrared radiation and re-radiate a portion of that back toward the Earth's surface, thereby trapping heat and warming the Earth's atmosphere. The most important naturally occurring GHG compounds are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃), and water vapor (H₂O). Carbon dioxide, methane, and nitrous oxide are produced naturally by respiration and other physiological processes of plants, animals, and microorganisms; by the decomposition of organic matter; by volcanic and geothermal activity; by naturally occurring wildfires; and by natural chemical reactions in soil and water. Ozone is not released directly by natural sources. It forms during complex chemical reactions in the atmosphere among organic compounds and nitrogen oxides in the presence of ultraviolet radiation. Water vapor is a strong GHG, although its concentration in the atmosphere is primarily a result of (not a cause of) changes in surface and lower atmospheric temperature conditions.

Although naturally present in the atmosphere, concentrations of carbon dioxide, methane, and nitrous oxide are also affected by emissions from industrial processes, transportation technology, urban development, agricultural practices, and other human activity. The Intergovernmental Panel on Climate Change (IPCC) estimates the following changes in global atmospheric concentrations of the most important GHGs (IPCC 2001, 2007):

- atmospheric concentrations of carbon dioxide have risen from a pre-industrial background of 280 parts per million by volume (ppm) to 379 ppm in 2005;
- atmospheric concentrations of methane have risen from a pre-industrial background of about 0.70 ppm to 1.774 ppm in 2005; and

• atmospheric concentrations of nitrous oxide have risen from a pre-industrial background of .270 ppm to 0.319 ppm in 2005.

The IPCC has concluded that these changes in atmospheric composition are almost entirely the result of human activity, not the result of changes in natural processes that produce or remove these gases (IPCC 2007).

Carbon dioxide, methane, and nitrous oxide have atmospheric residence times ranging from about a decade to more than a century. Several other important GHG compounds with long atmospheric residence times are produced almost entirely by various industrial processes. These include sulfur hexafluoride (SF₆), and a wide range of fluorinated hydrocarbons (HFCs). Fluorinated compounds typically have atmospheric residence times ranging from a few decades to thousands of years. The overall global warming potential of GHG emissions is presented typically in terms of carbon dioxide equivalents (CO₂e), using equivalency factors developed by the IPCC. The IPCC has published sets of CO₂e factors as part of its periodic climate change assessment reports issued in 1995, 2001, and 2007.

Of these pollutants, carbon dioxide, methane, and nitrous oxide are commonly emitted by oil and gas sources, while the remaining three GHGs are emitted in extremely small quantities, or are not emitted at all. As the major component of natural gas, CH₄ emissions resulting from oil and gas exploration, production, and transportation are considerable.

Aggregate GHG emissions are discussed in terms of carbon dioxide equivalent (CO₂e). Each GHG has a global warming potential (GWP). As defined by the EPA, the GWP provides a "ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that of one kilogram of CO₂" (GPO 2010). In other words, the GWP accounts for the intensity of each GHG's heat trapping effect and its longevity in the atmosphere. The GWP provides a method to quantify the cumulative impact of multiple GHGs released into the atmosphere by calculating CO₂e for the GHGs. The EPA's GWPs are provided in **Error! Reference source not found.** F-2.2, and were determined on a 100-year basis. These GWPs are established in EPA regulations in Title 40 of the Code of Federal Regulations (CFR) Part 98.

Table F-2.2: GHGs Reported to EPA and Global Warming Potentials

Air Pollutant	Chemical Symbol or Acronym	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH ₄	21
Nitrous oxide	N ₂ O	298
Hydrofluorocarbons	HFCs	Varies
Perfluorocarbons	PFCs	Varies
Sulfur hexafluoride	SF6	23,900

Sources: GPO 2009; GPO 2010, Table A-1.

To date, the EPA has not mandated stationary source GHG emission reductions or set NAAQS for these pollutants. The EPA does require certain GHG emission sources, and some GHG suppliers, to report GHG emissions. Beginning in 2011, large stationary sources of GHGs are required to obtain Air Quality Permits from local, State, or Federal air quality agencies (GPO 2010f).

The EPA estimates that national GHG emissions in 2006 were 6,801,812,000 tons CO₂e (EPA 2008). National GHG emissions in 2006 represented a 14 percent increase from estimated 1990 national GHG emissions (5,964,166,000 tons CO₂e). The EPA categorized the major economic sectors contributing to U.S. emissions of GHG compounds as:

- electric power generation (34.5 percent);
- transportation (28.6 percent);
- industrial processes (19.9 percent);
- agriculture (7.7 percent);
- commercial land uses (5.7 percent); and
- residential land uses (3.6 percent).

Air Quality Permit Programs

The CAA establishes a basic Air Quality Permit Program for industrial emission sources. Key elements of the Federal requirements include pre-construction permits [new source review and prevention of significant deterioration (PSD)] and annual Operating Permits (Title V). Separate reconstruction requirements have been established for non-attainment pollutants and for attainment pollutants. The Federal New Source Review (NSR) Program applies in nonattainment areas to the applicable non-attainment pollutants. A key element of the NSR Program is a requirement to implement emission offsets so that a new source of emissions will not result in a net increase in non-attainment pollutant emissions for the non-attainment area. The Federal PSD Program applies to attainment pollutants. Key elements of the PSD Program include potential requirements for pre-construction and post-construction ambient air quality monitoring; the establishment of baseline ambient air quality levels maximum cumulative pollutant increments allowed above those baseline levels; the evaluation of proposed emission sources in order to determine their consumption of available PSD pollutant increments; and the evaluation of visibility impacts in designated Class I Wilderness Areas, National Parks, and National Monuments. The Federal operating permit program is referred to as the Title V Permit Program, which establishes reporting and recordkeeping requirements designed to ensure that conditions imposed by pre-construction permits are being met.

States, in general, have assumed primary responsibility for enforcing most Federal permit requirements, with the EPA exercising a formal review and oversight responsibility. Some States, including Colorado, have separate air permit programs authorized by State legislation. State air permit requirements typically cover emission sources that are smaller than those subject to Federal permit requirements. In most cases, including Colorado, State air permit programs have been integrated with Federal NSR, PSD, and Title V requirements, to provide a consolidated permit program. Under consolidated permit programs, basic State permit requirements apply to all sources that are not specifically exempted. Additional NSR and PSD program requirements, including EPA review of the permit, become applicable if sources exceed various size or emission thresholds. The owners and operators of emission sources are the parties responsible for obtaining required air permits.

The Colorado Air Pollution Control Commission (APCD) administers State and Federal air permit programs in Colorado through the Colorado Air Pollution Control Division (APCD) of the Colorado Department of Public Health and Safety (CDPHE). In addition to permit programs for stationary emission sources, the Colorado APCD administers a State permit program that regulates open burning and prescribed fires. Colorado APCD Regulation 9 establishes separate permit programs for open burning and prescribed fires. The Colorado APCD administers the prescribed fire permit program throughout the State and administers the Open Burn Permit Program in most Counties. Administration of the Open Burn Permit Program has been delegated to some Counties (Boulder, Eagle, El Paso, Grand, Jefferson, Lake, Larimer, Los Animas, Mesa, Pueblo, Routt, Summit, and Weld). Prescribed fires smaller than *de minimis* thresholds set by Regulation 9 qualify for open burn permits.

State regulations define significant users of prescribed fire as local, State, or Federal agencies, or private landowners, that manage or own more than 10,000 acres of grassland or forest land in Colorado, and that plan to use prescribed fires, broadcast burns, or pile burns which are expected to generate more than 10 tons of PM_{10} in a calendar year. Significant users of prescribed fire are required to submit Prescribed Fire Plans and obtain Prescribed Fire Permits. Prescribed Fire Plans submitted by significant users of prescribed fire can cover a period of up to 10 years, and are subject to public review and comment. The BLM, the USFS, the NPS, and the USFWS have all received approval for their Prescribed Fire Plans.

Prevention of Significant Deterioration

The Federal CAA requires a planning program with the goal that all areas of the country achieve the Federal ambient air quality standards within various specified timeframes. For attainment areas that already meet the Federal ambient air quality standards, the Federal PSD Permit Program established a 3-tier classification defining the extent to which baseline air quality conditions can be degraded. Class I Areas have the smallest allowable air quality deterioration limits. Class II Areas allow greater deterioration of air quality, but these areas must maintain air quality conditions better than the Federal air quality standards. Class III Areas allow deterioration of air quality to the level of the Federal ambient air quality standards. The PSD program cumulative pollutant increments above baseline conditions have been established only for NO₂, SO₂, and PM₁₀. The incremental increases allowed for specific pollutants in Class I and Class II Areas are summarized in Table F-2.3, PSD Increments.

Table F-2.3: PSD Increments

Pollutant	Averaging Period	Class II PSD Increments	Class I PSD Increments
NO2	Annual2	25	2.5
PM10	241	30	8
PWHU	Annual	17	4
PM2.5	24	9	2
PWI2.3	Annual	4	1
	31	512	25
SO2	241	91	5
	Annual2	20	2

¹ No more than one exceedance per year.

² Annual arithmetic mean.

³ Average of annual fourth-highest daily maximum 8-hour average.

⁴ Category III Incremental standards (increase over established baseline).

Regional Haze Regulations

The CAA requires the EPA to protect visibility conditions in the Class I Areas established under the PSD program, unless the responsible land management agency determines that visibility is not an important air quality value for a particular area. The CAA also requires the development of programs designed to remedy existing visibility impairment in Class I Areas if that visibility impairment results from human-made air pollution. The EPA has identified two general types of visibility impairment at Class I Areas: 1) impairment due to smoke, dust, colored gases, or layered haze attributable to a single stationary emission source or a small group of emission sources; and 2) impairment due to widespread, regionally homogeneous haze resulting from the cumulative emissions of varied emission sources in a region. The PSD permit program addresses visibility impairment from nearby stationary emission sources. Regional haze impacts resulting from cumulative emissions in a region are being addressed through new SIP planning requirements. Colorado submitted a SIP Amendment to the EPA in December of 2007, to address regional haze issues. One of the components of the regional haze SIP is implementation of best available retrofit technology (BART) emission controls on certain categories of existing stationary emission sources, including power plants, cement kilns, and industrial boilers, that were built prior to 1977, if their emissions are reasonably expected to contribute to visibility degradation in Class I Areas. The CAA established an initial list of 158 Class I Areas comprised, primarily, of Wilderness Areas, National Parks, and National Monuments. Five Native American tribal areas have subsequently been added to the list of Class I Areas. The remainder of the country is designated as Class II Areas. No areas have been designated as Class III Areas under the PSD Program. One element of the PSD Permit Program is a review of the extent to which a proposed emission source will impair visibility conditions in Class I Areas.

Clean Air Act Conformity Requirements

Section 176(c) of the CAA requires Federal agencies to ensure that actions undertaken in non-attainment or maintenance areas are consistent with the CAA, and with federally enforceable Air Quality Management Plans. The EPA has promulgated separate rules that establish conformity analysis procedures for highway and mass-transit projects (40 CFR Part 93, Subpart A) and for other (general) Federal agency actions (40 CFR Part 93, Subpart B). General conformity requirements are, potentially, applicable to many Federal agency actions, although they apply only to those aspects of an action that involve ongoing Federal agency responsibility and control over direct or indirect sources of air pollutant emissions when those actions occur within non-attainment or maintenance areas.

The general conformity rule establishes a process that is intended to demonstrate that the proposed Federal action:

- will not cause, or contribute to, new violations of Federal air quality standards;
- will not increase the frequency or severity of existing violations of Federal air quality standards; and
- will not delay the timely attainment of Federal air quality standards.

The general conformity rule applies to Federal actions occurring in non-attainment or maintenance areas when the net change in total direct and indirect emissions of non-attainment pollutants or their precursors exceeds specified thresholds. The emission thresholds that trigger the requirements of the conformity rule are called *de minimis* levels. Emissions associated with stationary sources that are subject to permit programs incorporated into the SIP are not counted against the *de minimis* threshold. The CAA general conformity *de minimis* threshold for PM₁₀ maintenance areas is 100 tons of PM₁₀ emissions per year.

Compliance with the conformity rule can be demonstrated in several ways. Compliance is presumed if the net increase in direct and indirect emissions resulting from a Federal action would be less than the relevant *de minimis* level. If net emissions increases exceed the relevant *de minimis* value, a formal conformity determination process must be followed. Federal agency actions subject to the general conformity rule cannot proceed until there is a demonstration of consistency with the SIP through one of the following mechanisms:

- by dispersion modeling analyses demonstrating that direct and indirect emissions resulting from the Federal action will not cause, or contribute to, violations of Federal ambient air quality standards;
- by showing that direct and indirect emissions resulting from the Federal action are specifically identified and accounted for in an approved SIP;
- by showing that direct and indirect emissions associated with the Federal agency action are accommodated within emission forecasts contained in an approved SIP;
- by showing that emissions associated with future conditions will not exceed emissions that would occur from a continuation of historical activity levels;
- by arranging emission offsets to fully compensate for the net emissions increase associated with the action:
- by obtaining a commitment from the relevant air quality management agency to amend the SIP to account for direct and indirect emissions resulting from the Federal agency action; or
- in the case of regional water or wastewater projects, by showing that any population growth accommodated by such projects is consistent with growth projections used in the applicable SIP.

Dispersion modeling analyses can be used to demonstrate conformity only in the case of primary pollutants such as carbon monoxide or directly emitted PM_{10} . Modeling analyses cannot be used to demonstrate conformity for ozone because the available modeling techniques, generally, are not sensitive to site-specific emissions. No portions of the Planning Area have any Federal non-attainment or maintenance designations.

Ambient Air Quality

Existing air quality data for the Planning Area is summarized in Chapter 3, Affected Environment. The available data indicate that State and Federal ambient air quality standards for criteria pollutants are not exceeded at existing monitoring locations.

Based upon the BLM's request, the CDPHE provided background air quality data to be used in the Air Quality Assessment for the DRMP/DEIS (Chick 2008). Appropriate background concentrations were provided for areas close to Walden, Colorado, where a portion of the development potential exists. Table F-3.1 lists the background concentrations provided by the CDPHE. Ambient background concentrations demonstrate that the entire Planning Area is in attainment for all applicable NAAQS.

Table F-3.1 Background Ambient Air Quality Concentrations

Pollutant	Averaging Period	Measured Background Concentration	Basis for background concentration
PM_{10}	24-hr (2 nd Max) Annual	23 μg/m ³ 11 μg/m ³	Colowyo Axial, West Site, 1997 to1998
PM ₁₀	24-hr (2 nd Max) Annual	56 μg/m ³ 30 μg/m ³	Rifle, Garfield County. (2006 data)
SO_2	3-hr (2 nd Max) 24-hr (2 nd Max) Annual	0.009 ppm (23.98 μg/m³) 0.005 ppm (13.32 μg/m³) 0.002 ppm (5.33 μg/m³)	Unocal, 1983 to 1984
SO_2	1-hr (99 th Percentile) 3-hr (2 nd Max) 24-hr (2 nd Max) Annual	0.031 ppm (80.8 μg/m³) 0.026 ppm (66.6 μg/m³) 0.013 ppm (34.6 μg/m³) 0.002 ppm (5.3 μg/m³)	Colorado College, Colorado Springs, El Paso County. (2005- 2006)

Table F-3.1 Background Ambient Air Quality Concentrations

Pollutant	Averaging Period	Measured Background Concentration	Basis for background concentration
NO ₂	Annual	0.005 ppm (3.83 µg/m ³)	Rural default based on Encana Near Parachute Creek, 2007
NO ₂	1-hr (Max)	0.037 ppm (70.75 μg/m3)	Holcim/Golden (2005- 2006)
СО	1-hr (2 nd Max) 8-hr (2 nd Max)	1 ppm (1,165 μg/m³) 1 ppm (1,165 μg/m³)	Rural default based on American Soda, Piceance 2003 to 2004
PM _{2.5}	98 th Percentile Annual	16 μg/m ³ 6 μg/m ³	Rural default based on Chatfield State Park, 2006
Ozone	1-hr (2 nd Max) 8-hr (4 th Max)	0.058 ppm (116 μg/m³) 0.053 ppm (106 μg/m³)	Golden Energy Florence, 2005 to 2006
Ozone	1-hr (2 nd Max) 8-hr (4 th Max)	0.088 ppm (176 μg/m ³) 0.075 ppm (150 μg/m ³)	Rocky Mountain National Park, 2004 to 2006

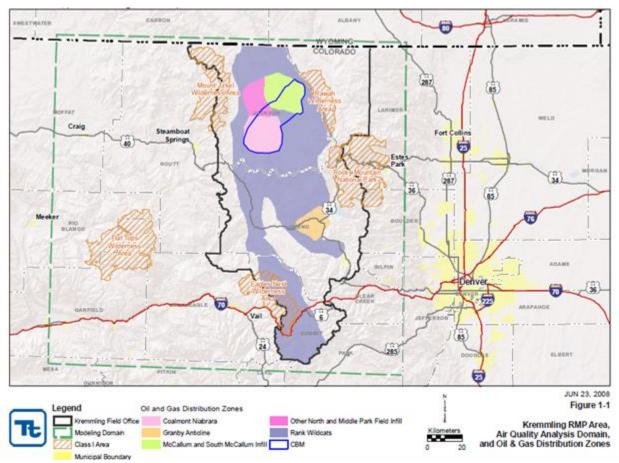
Class I Areas

There are 12 PSD program Class I visibility protection areas in Colorado. Five of Colorado's Class I visibility protection areas are in, or close to, the Planning Area: Rocky Mountain National Park, the Mount Zirkel Wilderness, the Rawah Wilderness, the Eagles Nest Wilderness, and the Flat Tops Wilderness. The Rawah Wilderness Area is located completely in the Planning Area, while Rocky Mountain National Park and the Eagles Nest and Mount Zirkel Wilderness Areas have a portion of the Class I PSD area located in the Planning Area. Table F-3.2 lists the distance and location to the applicable Class I PSD areas, which are approximated from the center of the Planning Area. Figure F-3.1 illustrates the location of the Class I PSD areas relative to the Planning Area.

Table F-3.2 Distance and Direction to Class I Area

Class I Area	Distance from Centerpoint (km)	Direction from Centerpoint	Distance to Centroid of Closest Oil and Gas Distribution Zone (km)
Mount Zirkel Wilderness Area	Adjacent	Northwest	17
Flat Tops Wilderness Area	100	Southwest	77
Rawah Wilderness Area	Inside Planning Area	Northeast	14
Rocky Mountain National Park	Adjacent	East	28
Eaglesnest Wilderness Area	Adjacent	Southwest	37





Project Emissions

An emissions inventory was developed for Alternative B in the DRMP/DEIS, and include oxides of nitrogen (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than or equal to 10 microns in size (PM_{10}), particulate matter less than or equal to 2.5 microns in size ($PM_{2.5}$), and volatile organic compounds (VOC_s) for oil and gas production activities within the Planning Area. In addition, GHG emissions were calculated, including CO_2 , CH_4 , and N_2O for oil and gas and CH_4 from enteric fermentation from livestock grazing. Inventories were based upon emission factors from various sources including, but not limited to, manufacturer's data where available, and EPA AP-42, and EPA Gas Research Institute (EPA) emission factors (EPA 1997). (While under contract, EPA Tech prepared an assumptions document and shared it with the KFO staff to ensure that activity assumptions and parameters used in the emissions calculations were appropriate.)

The emissions inventory developed for Alternative B was used to project impacts for Alternatives A, C and D. The overall development in Alternative B was assumed to be greater than any of the other alternatives, and the impacts for the other alternatives was assumed to be less.

Alternative A

Alternative A, the No Action Alternative, assesses the continuation of current management, assuming no change from current management direction. Emissions are based upon current oil and gas activity in the Planning Area, the projections of the 1991 Colorado Oil and Gas Leasing and Development RMP Amendment/Environmental Impact Statement (EIS), which analyzed oil and gas development in the Planning Area (BLM 1991b).

The 1991 RMP Amendment analyzed the impacts of 108 wells (40 wildcat wells and 68 development wells). The RMP Amendment assumed 19 acres of disturbed area per well for a total disturbed area of 2,044 acres. A the time of the emissions inventory, there were 109 active wells in the Planning Area, which is one more well than the projected 108 wells (BLM 1991b). Seventy-seven of the 109 wells are located on Federal lands. Most of the 109 wells are located in the McCallum fields. The existing wells have a disturbed acreage of approximately 2 to 3 acres per well, as opposed to the projected 19 acres in the 1991 RMP Amendment. Alternative A assumes 1 well per pad, and a disturbed area of 3 acres per well. This scenario assumes the same well pad configuration as the RFD Scenario (BLM 2008r). Each well pad will include one separator, two water tanks, and four production tanks. Electricity will be driven by a gas-fired generator.

Alternative B

The RFD Scenario (BLM 2008r) forecasts the amount of drilling activity that could possibly occur in the 20 year period between 2009 and 2028 on Federal, State, and private lands in the Planning Area. The future anticipated drilling activity outlined in the RFD is 370 oil and gas wells (192 wells on Federal lands and 178 wells on fee lands). It is assumed that the 370 wells will be drilled with vertical well bores over a 20 year period, with the expected average life of a well to be 40 years.

Based upon the RFD, it is assumed that there is one well per well pad (BLM 2008r). The average disturbance per well is estimated to be 8 acres, 4 acres for a drill pad, 2 acres for roads, and 2 acres for other infrastructure. The total potential anticipated surface disturbance at the end of the 20 year period is 4,310 acres. This is based upon an existing surface disturbance area of 1,350 acres and 2,960 new acres of disturbed land. The anticipated disturbance area is the gross acreage. The net acreage would be significantly lower due to the reclamation of plugged and abandoned wells. According to the RFD, the existing 1,350 acres of disturbed land (in 2008) accounts for the plugging and reclamation to date (BLM 2008r). The year of peak overall emissions from oil and gas development activities is estimated to be 2028.

Cumulative Analysis

Far-field cumulative impacts of oil and gas activities will be addressed in a qualitative manner; cumulative sources were not included in the Emissions Inventory. Air Quality results from the DRMP/DEIS are referenced in the cumulative impacts analysis. See Chapter 4, Environmental Consequences.

Well Location Assumptions

Future potential oil and gas activity in the Planning Area is highly speculative, and little is known about the exact well locations for future development. Due to this uncertainty, modeling analysis to predict potential impacts to air quality was not considered a scientifically defensible analysis.

Assumptions about the type of field production (such as oil or gas) for Alternative B were based upon the RFD Scenario (BLM, 2008r). While well locations are speculative, oil and gas 'Distribution Zones' were created to provide the public and the decision-maker with a visual guide of where current activity exists, and a 'best guess' of where potential future might occur. See Tables F-4.1 and F-4.2. It should be noted, however, that the Alternative B Distribution Zone is just a best guess, without a high degree of certainty. As mentioned above, when adequate data becomes available, such as during the project application and environmental analysis stage, it may become necessary to require air quality modeling to

assess the potential impacts resulting from future activities prior to authorization by the BLM.

Table F-4.1 Current Activity (Alternative A) by Distribution Zone

Field Name	Current Producing Wells
Coalmont Niobrara	7
CBM	0
Granby Anticline	0
McCallum and South McCallum Infill	84
Other North and Middle Park Field Infill	1
Rank Wildcats	17
Total	109

Table F-4.2 Future Anticipated Activity by Distribution Zone (Alternative B)

Field Name	Current Producing Wells
Coalmont Niobrara	234
СВМ	40
Granby Anticline	16
McCallum and South McCallum Infill	40
Other North and Middle Park Field Infill	20
Rank Wildcats	20
Total	370

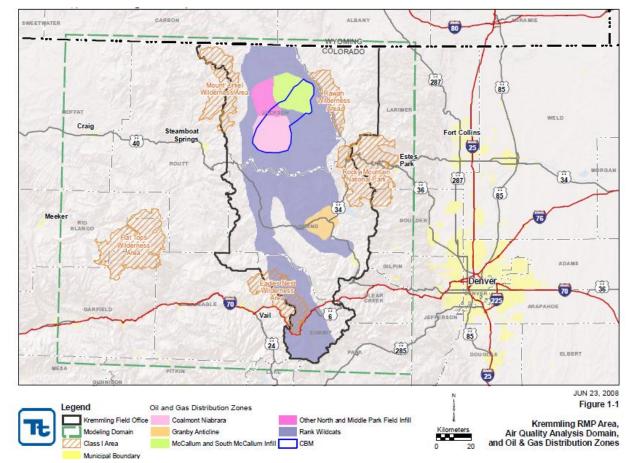


Figure F-4.1 Distribution Zones for Potential Oil and Gas Development

Construction Emissions

Construction emissions for Alternatives A and B included well pad and resource road construction and traffic; rig move and drilling, and associated, traffic; completion and testing, and associated, traffic; and wind erosion during construction activities. Construction emissions for oil and natural gas wells were assumed to be identical.

Production Emissions

Production emissions included combustion engine emissions and fugitive dust resulting from road travel to, and from, well sites; diesel combustion emissions from haul trucks; combustion emissions from well site heaters; condensate storage tank flashing and flashing control; wind erosion from well pad disturbed areas; and emissions from wellhead engines.

Emission Calculations

Tables 5.1 through 5.24 provide a detailed analysis of the emission calculations that were performed for this RMP, and include the equations and assumptions that were used to prepare the Emissions Inventory. Tables 5.21 through 5.24 provide per-well totals for 2009, 2011, 2028, and the total emissions by year, respectively.

Note: In the following tables, text in red indicates updated information from that in the DRMP/DEIS.

Converting files to the format of this document may have altered the resolution of the tables, therefore, the tables may not be of the highest quality. A PDF copy of the following tables can be found in the online version of the PRMP/FEIS at: http://www.blm.gov/co/st/en/fo/kfo/planning.html

Alternatively, a copy can be requested from the Kremmling Field Office:

Kremmling Field Office Dennis Gale, PRMP/FEIS Project Manager PO Box 68 2103 East Park Avenue Kremmling, CO 80459 Phone: 970-724-3000

FAX: 970-724-3066 kfo_webmail@blm.gov 1

Table 5.1										
Emission Source:	WELL PAD CO	NSTRUCTION -	GENERAL CONST	RUCTION ACTIV	ITY EMISSION	S				
Emission Factor From:	AP-42, Section	13.2.3 (EPA 19	95)							
	"Heavy Construc	ction Operations	"							
	AP-42, Section	13.2.2 (EPA 19	95)							
	"Revision to fine	fraction rations	"							
	TSP=	1.2	tons/acre/month							
Emission Equation:	Emissions (TPY	') = EF (tons/ac	re/month) x Area (ac	re) x Equipment	Time (hours)					
Area nor Well Ded	Equipment Time per Well Pad	Emission Control	TSP Uncontrolled Emissions per Well Pad	TSP Controlled Emissions per Well Pad	PM ₁₀ Conversion	PM _{2.5}	Per V	ed Emissions Vell Pad b/yr)	Controlled Per We (lbs)	ell Pad
Area per Well Pad (acre)	(hours)	Efficiency	(lbs/year)	(lbs/year)	Factor ¹	Factor ¹	PM10	PM2.5	PM10	PM2.5
8	70	80%	1841.10	1472.88	0.25	0.15	460.27	69.04	368.22	55.23
Notes:										
¹ PM ₁₀ = 0.25*TSP; PM ₂	$_{2.5} = 0.15^* PM_{10}.$	Conversion factor	or from AP-42 13.2.2							
Construction activity inclu					pad.					
•										

Table 5.2														
Emission Source:	WELL PAD	CONSTRU	CTION - VE	HICLE ROAD	DUST EMI	SSIONS								
Emission Factor From:	AP-42 Sec													
	unpaved R	oads - Indus	strial Roads"											
Emission Factor ⊨quaτιon:	E = k x (s/1	2) ^a x (W/3) ^b)											
Where:	E =	Size-specif	fic emission	factor (lb/VMT)									
			aterial silt co											
	W =	Mean vehic	le weight (to	ns)										
				ticle size mult	iplier									
		Empirical of												
		Empirical of												
			(DM40											
Data:	k =		for PM10											
	k =		for PM2.5	- I DN40.5										
	a=		for PM10 ar											
	b=	0.45	for PM10 ar	na PIVI2.5										
	Number of				Average		Vehicle Miles		PM10	PM2.5	Uncontrolled	Controlled	Uncontrolled	Controlled
	Round			Total	Vehicle	Silt	Travelled per		Emission	Emission	PM10	PM10	PM2.5	PM2.5
	Trips per	Days on	Number of	Number of	Weight	Content ¹	Vehicle	Control	Factor	Factor	Emissions	Emissions	Emissions	Emissions
Vehicle	Day	Location	Vehicles	Round Trips	(tons)	(%)	(VMT/vehicle)	Efficiency	(lb/VMT)	(lb/VMT)	(lb/pad)	(lb/pad)	(lb/pad)	(lb/pad)
low boy hauler	5	2	1	10	40	24	6	80%	8.98	0.90	538.76	431.00	53.88	43.10
gravel hauler	10	3	3	90	26	24	6	80%	7.40	0.74	3994.34	3195.48	399.43	319.55
water truck (road dust control)	6	3	1	18	26	24	6	80%	7.40	0.74	798.87	639.10	79.89	63.91
light duty vehicles (employee access)	1	7	2	14	4.6	24	6	80%	3.39	0.34	284.99	227.99	28.50	22.80
										TOTAL	5616.96	4493.57	561.70	449.36
¹ Silt content from AP-42 Table 13.2.2-	1 for a freebly	, graded bar	ıl road											
OIL COILCIL HOIH AF "42 TADIE 13.2.2"	ı ıvı a iitəlliy	grautu Hal	ıı ıvau.											

Proposed Resource Management Plan and Final Environmental Impact Statement
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Table 5.3																
Emission Source:	WELL PAD C	CONSTRUCT	TION - HEAV	Y EQUIPM	ENT EXHA	JST EMISS	IONS									
Emission Factor From:	AP-42, Volum															
	"Emissions F	actors for Co	onstruction E	quipment"												
Emission Equation:	Emissions (TI	PY) = grams	pollutant/ye	ear / 453.59	grams / 200	00 lbs x Loa	d Factor									
	SO2 Emission	ns (TPY) = g	grams SO2/y	ear / 453.5	9 grams / 20	000 lbs x Lo	ad Factor x	Ultra Low S	ulfur Adjustm	ent						
					Emission F	actors1 (g/h										
Equipment	CO	NO_x	PM ₁₀	$PM_{2.5}^{2}$	SO ₂	VOC	CO ₂ ⁶	CH ₄ ⁷	N_2O^7	Form.	Benzene	Toluene	Xylene			
Dozer ⁵	2.15	7.81	0.692	0.692	0.851	0.75	521.6	0.0252	0.0155		0.002962					
Grader	2.45	7.46	0.789	0.789	0.901	0.55	521.6	0.0252	0.0155			0.001299				
Motor Grader	2.45	7.46	0.789	0.789	0.901	0.55	521.6	0.0252	0.0155			0.001299				
Backhoe	2.45	7.46	0.789	0.789	0.901	0.55	521.6	0.0252	0.0155	0.003747	0.002962	0.001299	0.000905			
	Engine	Operating														
	Horsepower	Load	Durations					P	olluntant Em	issions (lbs	/well pad)					
Equipment	(hp)	Factor	(hours) ³	CO	NO_x	PM ₁₀	$PM_{2.5}$	SO ₂ ⁴	VOC	CO ₂	CH₄	N ₂ O	Form.	Benzene	Toluene	Xylene
bulldozer	300	0.4	70	39.82	144.63	12.82	12.82	0.47	13.89	9660.0	0.47	0.29	0.07	0.05	0.02	0.02
grader	165	0.4	70	24.95	75.98	8.04	8.04	0.28	5.60	5313.0	0.26	0.16	0.04	0.03	0.01	0.01
motor grader	165	0.4	70	24.95	75.98	8.04	8.04	0.28	5.60	5313.0	0.26	0.16	0.04	0.03	0.01	0.01
backhoe	100	0.4	70	15.12	46.05	4.87	4.87	0.17	3.40	3220.0	0.16	0.10	0.02	0.02	0.01	0.01
			TOTAL	104.85	342.65	33.76	33.76	1.19	28.49	23506.0	1.13	0.70	0.17	0.13	0.06	0.04
Notes:																
¹ AP-42, Volume II - Mobile	Sources (EDA	1085) "Emi	ssions Fact	ore for Cons	truction Fau	inment"										
² PM _{2.5} emissions assume				JI3 101 CO113	struction Eqt	принени										
³ Assumes 10 hours per da																
⁴ Ultra Low Sulfur adjustment	, ,	5 ppm Ultra	l ow Sulfur d	iesel fuel si	ılfur content	compared t	o 500 ppm <i>(</i>	0 05 percen	t) #2 diesel fi	uel sulfur co	ntent					
⁵ Emission factor for track		ppin Ollia	Low Canara	10001 1001 00	and contone	oompared t	o ooo ppiii (o.oo poroon	, " <u>-</u> alogor ic	Joi Gallal GO	inoin.					
⁶ From AP-42 Section 3-3	• •	nission Fact	ors for Linco	ntrolled Gar	soline and D	iesel Indust	rial Engines									
⁷ Compendium of Greenhou									of 0.08 a/L	of diagol fuc	l Diocol d	oncity 850	a/I · hooting	unduo 10 2	00 Rtu/lb	

Volume Three

NOx 6.49 1.18 0.651	PM10 n/a n/a n/a		59 grams / 2 mission Fac SO2 0.32 n/a		CO ₂ ⁵ 1700	CH ₄ ⁶ 0.070	N ₂ O ⁷ 0.0432	Formaldehyde ⁸			Xylene ⁸						
NOx 6.49 1.18	PM10 n/a n/a	En PM2.5 ⁴ n/a n/a	mission Fac SO2 0.32	tors (g/VM ⁻ VOC 4.82	CO ₂ ⁵ 1700						,						
6.49 1.18	n/a n/a	PM2.5 ⁴ n/a n/a	SO2 0.32	VOC 4.82	CO ₂ ⁵ 1700						,						
6.49 1.18	n/a n/a	PM2.5 ⁴ n/a n/a	SO2 0.32	VOC 4.82	CO ₂ ⁵ 1700						,						
6.49 1.18	n/a n/a	n/a n/a	0.32	4.82	1700						,						
1.18	n/a	n/a				0.070	0.0432	0.0107									
			n/a	0.74				0.0107	0.0085	0.00371	0.0026						
			n/a	0.74													
0.651	n/a	n/a			230	0.018	0.0505	0.0286	0.0148	0.00371	0.0026						
0.651	n/a	n/a															
			n/a	0.562	330	0.119	0.0541	0.0085	0.0151	0.00371	0.0026						
		Number of	Round														
		Round	Trip														
Days on	Number of	Trips Per	Distance	VMT						Pollutant E	missions (lbs	s/well pad)		ı			
Location	Vehicles	Day	(mi)	(mi)	CO	NOx	PM10	PM2.5	SO2 ¹⁰	VOC	CO2	CH4	N2O	Formaldehyde	Benzene	Toluene	Xylene
2	1	5	6	60	2.26	0.86	na	na	0.001	0.64	224.87	0.0093	0.0057	0.0014	0.0011	0.0005	0.0003
3	3	10	6	540	20.31	7.73	na	na	0.011	5.74	2,023.85	0.0837	0.0515	0.0127	0.0101	0.0044	0.0031
3	1	6	6	108	4.06	1.55	na	na	0.002	1.15	404.77	0.0167	0.0103	0.0025	0.0020	0.0009	0.0006
7	1	1	6	42	0.23	0.11	na	na	na	0.07	21.30	0.0016	0.0047	0.0026	0.0014	0.0003	0.0002
7	1	1	6	42	0.89	0.06	na	na	na	0.05	30.56	0.0110	0.0050	0.0008	0.0014	0.0003	0.0002
				TOTAL	27.76	10.30	na	na	0.015	7.64	2,705.35	0.1224	0.0772	0.0201	0.0160	0.0065	0.0045
H "Heaw [Outy Diesel	Trucks" high	h altitude "a	aged" with 5	0 000 miles	service 2	001+ model	l vear (FPA 1995)								
	Location 2 3 7 7	Location Vehicles 2 1 3 3 3 1 7 1 7 1 H, "Heavy Duty Diesel"	2 1 5 3 3 10 3 1 6 7 1 1 7 1 1	Location Vehicles Day (mi)	Location Vehicles Day (mi) (mi)	Location Vehicles Day (mi) (mi) CO 2 1 5 6 60 2.26 3 3 10 6 540 20.31 3 1 6 6 108 4.06 7 1 1 6 42 0.23 7 1 1 6 42 0.89 TOTAL 27.76	Location Vehicles Day (mi) (mi) CO NOx 2 1 5 6 60 2.26 0.86 3 3 10 6 540 20.31 7.73 3 1 6 6 108 4.06 1.55 7 1 1 6 42 0.23 0.11 7 1 1 6 42 0.89 0.06 TOTAL 27.76 10.30	Location Vehicles Day (mi) (mi) CO NOx PM10 2 1 5 6 60 2.26 0.86 na 3 3 10 6 540 20.31 7.73 na 3 1 6 6 108 4.06 1.55 na 7 1 1 6 42 0.23 0.11 na 7 1 1 6 42 0.89 0.06 na TOTAL 27.76 10.30 na	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 2 1 5 6 60 2.26 0.86 na na 3 1 6 540 20.31 7.73 na na 3 1 6 6 108 4.06 1.55 na na 7 1 1 6 42 0.23 0.11 na na 7 1 1 6 42 0.89 0.06 na na 7 1 1 6 42 0.89 0.06 na na 7 1 1 6 42 0.89 0.06 na na 7 1 27.76 10.30 na na na	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ 2 1 5 6 60 2.26 0.86 na na 0.001 3 3 10 6 540 20.31 7.73 na na 0.011 3 1 6 6 108 4.06 1.55 na na 0.002 7 1 1 6 42 0.23 0.11 na na na 7 1 1 6 42 0.89 0.06 na na na	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC 2 1 5 6 60 2.26 0.86 na na 0.001 0.64 3 3 10 6 540 20.31 7.73 na na 0.011 5.74 3 1 6 6 108 4.06 1.55 na na 0.002 1.15 7 1 1 6 42 0.23 0.11 na na na 0.07 7 1 1 6 42 0.89 0.06 na na na 0.015 7.64 TOTAL 27.76 10.30 na na 0.015 7.64	Location Vehicles Day (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC CO2 2 1 5 6 60 2.26 0.86 na na 0.001 0.64 224.87 3 3 10 6 540 20.31 7.73 na na 0.011 5.74 2,023.85 3 1 6 6 108 4.06 1.55 na na 0.002 1.15 404.77 7 1 1 6 42 0.23 0.11 na na na 0.07 21.30 7 1 1 6 42 0.89 0.06 na na na 0.05 30.56 7 1 1 6 42 0.89 0.06 na na na 0.015 7.64 2,705.35	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC CO2 CH4 2 1 5 6 60 2.26 0.86 na na 0.001 0.64 224.87 0.0093 3 1 6 540 20.31 7.73 na na 0.011 5.74 2,023.85 0.0837 3 1 6 6 108 4.06 1.55 na na 0.002 1.15 404.77 0.0167 7 1 1 6 42 0.23 0.11 na na na 0.07 21.30 0.0016 7 1 1 6 42 0.89 0.06 na na na 0.015 7.64 2,705.35 0.1224	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC CO2 CH4 N2O 2 1 5 6 60 2.26 0.86 na na 0.001 0.64 224.87 0.0093 0.0057 3 3 10 6 540 20.31 7.73 na na 0.011 5.74 2,023.85 0.0837 0.0515 3 1 6 6 108 4.06 1.55 na na 0.002 1.15 404.77 0.0167 0.0103 7 1 1 6 42 0.23 0.11 na na na 0.07 21.30 0.0016 0.0047 7 1 1 6 42 0.89 0.06 na na na 0.05 30.56 0.0110 0.0050 7 1 1 6 42 0.89	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC CO2 CH4 N2O Formaldehyde	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC CO2 CH4 N2O Formaldehyde Benzene 2 1 5 6 60 2.26 0.86 na na 0.001 0.64 224.87 0.0093 0.0057 0.0014 0.0011 3 1 6 540 20.31 7.73 na na 0.011 5.74 2,023.85 0.0837 0.0515 0.0127 0.0101 3 1 6 6 108 4.06 1.55 na na 0.002 1.15 404.77 0.0167 0.0103 0.0025 0.0020 7 1 1 6 42 0.23 0.11 na na na 0.07 21.30 0.0016 0.0047 0.0026 0.0014 7 1 1 6 42 0.89 0.06 na na na <td< td=""><td> Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2¹⁰ VOC CO2 CH4 N2O Formaldehyde Benzene Toluene </td></td<>	Location Vehicles Day (mi) (mi) CO NOx PM10 PM2.5 SO2 ¹⁰ VOC CO2 CH4 N2O Formaldehyde Benzene Toluene

² AP-42, Volume II - Mobile Sources, Appendix H, "Light Duty Diesel Trucks" high altitude, "aged" with 50,000 miles service, 1990+ model year for NOx, 1984+ model year for CO and HC (EPA 1995).

Table 5.4

³ AP-42, Volume II - Mobile Sources, Appendix H, "Light Duty Gasoline Trucks I" high altitude, "aged" with 50,000 miles service, 1998+ model year (EPA 1995).

⁴ PM2.5 emissions assumed equal to PM10 emissions (no PM emission factors avialable from EPA).

⁵ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry, Table 4-11 (HDDV diesel non-semi truck, LDGT average gasoline car, LDDV large diesel car), CO2 Mobile Source Emission Factors, American Petroleum Institute (2004).

6 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry for CH4, Table 4-9 (HDDV moderate control, LDGT oxidation catalyst, LDDT moderate control), Mobile Source Combustion Emission Factors, Table 4-10 (HDDV Diesel heavy truck, LDGT Gasoline light truck, LDDT Diesel light truck), Default Fuel Economy Factors for Different Types of Mobile Sources, American Petroleum Institute (2004).

⁷ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry for N2O, Table 4-9 (HDDV moderate control, LDGT oxidation catalyst, LDDT moderate control), Mobile Source Combustion Emission Factors, Table 4-10 (HDDV Diesel heavy truck, LDGT Gasoline light truck, LDDT Diesel light truck), Default Fuel Economy Factors for Different Types of Mobile Sources, American Petroleum Institute (2004).

AP-42, Section 3.3, "Gasoline and Diesel Industrial Engines. Table 3.3-2, "Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines"

⁹ For light duty vehicles (pickup trucks), 60 percent would be diesel-powered, and 40 percent would be gas.

¹⁰ Included in the Pollutant Emissions is the Ultra Low Sulfur adjustment based on 15 ppm Ultra Low Sulfur diesel fuel sulfur content compared to 500 ppm (0.05 percent) #2 diesel fuel sulfur content. (15/500=0.03)

Table 5.5														
Emission Source:	WELL CONST	RUCTION - V	EHICLE RO	DAD DUST E	MISSION	S								
Emission Factor From:	AP-42, Section													
	"Unpaved Roads	s" – Industria	al roads											
Explanation:														
Emission Factor Equation:	$E = k \times (s/12)^a$	x (W/3) ^b												
Where:	E =	Size-specifi	c emission f	actor (lb/VM	T)									
	s =	Surface ma	terial silt cor	ntent (%)										
	W =	Mean vehic	le weight (to	ns)										
	k =	Empirical c	onstant, part	icle size mul	tiplier									
	a =	Empirical c	onstant											
	b =	Empirical c	onstant											
Data:	k =	1.5	for PM10											
	k =		for PM2.5											
	a=	0.9	for PM10 a	nd PM2.5										
	b=	0.45	for PM10 a	nd PM2.5										
				Total										
				Number of	Mean		Vehicle Miles		PM10	PM2.5	Uncontrolled	Uncontrolled	Controlled	Controlled
	Number of			Round	Vehicle	Silt	Travelled per		Emission	Emission	PM10	PM2.5	PM10	PM2.5
	Round Trips	Days on	Number of	Trips (per	Weight	Content ¹	Vehicle	Control	Factor	Factor	Emissions	Emissions	Emissions	Emissions
Vehicle	per Day	Location	Vehicles	year?)	(tons)	(%)	(VMT/vehicle)	Efficiency	(lb/VMT)	(lb/VMT)	(lbs/pad)	(lbs/pad)	(lbs/pad)	(lbs/pad)
Fuel tanker	1	1	1	1	40	24	6	80%	8.98	0.90	0.03	0.00	0.02	0.00
Logging truck	1	2	1	2	26	24	6	80%	7.40	0.74	0.04	0.00	0.04	0.00
Cementer truck	1	2	1	2	40	24	6	80%	8.98	0.90	0.05	0.01	0.04	0.00
Cement supply truck	1	2	2	4	40	24	6	80%	8.98	0.90	0.11	0.01	0.09	0.01
Casing crew	1	2	1	2	6	24	6	80%	3.82	0.38	0.02	0.00	0.02	0.00
Laydown machine	1	2	1	2	26	24	6	80%	7.40	0.74	0.04	0.00	0.04	0.00
Water truck	2	37	1	74	40	24	6	80%	8.98	0.90	1.99	0.20	1.59	0.16
Light duty vehicles (trips for bits)	2	5	1	10	6	24	6	80%	3.82	0.38	0.11	0.01	0.09	0.01
Light duty vehicles (employee access)	1	37	11	407	4.6	24	6	80%	3.39	0.34	4.14	0.41	3.31	0.33
Rig hauler	5	2	1	10	40	24	6	80%	8.98	0.90	0.27	0.03	0.22	0.02
TOTAL													5.46	0.55
¹ Silt content from AP-42 Table 13.2.2-	1 for a freshly gra	aded haul ro	ad.											

Table 5.6																			
Emission Source:	WELL CO	NSTRUCTIO	N - VEHICL	E EXHAUST	EMISSIONS														
Emission Equation:	Emissions	(TPY) = gran	ms/VMT x V	MT / 453.59	grams / 2000	lbs													
					Emission	Factors (g/V	MT) ^{1,2,3}												
Equipment	CO	NOx	PM10	PM2.5 ⁴	SO2	VOC	CO2 ⁵	CH4 ⁶	N2O ⁷	Formaldehyde ⁸	Benzene ⁸	Toluene ⁸	Xylene ⁸						
HD Diesel Engine Trucks (HDDV)	17.06	6.49	n/a	n/a	0.32	4.82	1700	0.070	0.0432	0.0107	0.0085	0.00371	0.0026						
LD Diesel Trucks (60 percent)9																			
(LDDV)	2.53	1.18	n/a	n/a	n/a	0.74	230	0.018	0.0505	0.0286	0.0148	0.00371	0.0026						
LD Gas Trucks (40 percent)																			
(LDGV)	9.659	0.651	n/a	n/a	n/a	0.562	330	0.119	0.0541	0.0085	0.0151	0.00371	0.0026						
				Number of							Pollu	tant Emissi	one (lbe/wo	II nad\					
					D I Total						Foliu	italit Lillissi	T (IDS/WE	ii pau)					
	01	Days on		Round	Round Trip														
Fortraced	Class of	1 1	# of	Trips Per	Distance	VMT	00	NO	D1440	DM0.5	SO2 ¹¹	V/00	000	0114	NICO	Farmed data and	D	T.1	V. I.
Equipment	Vehicle	Location ¹⁰	Vehicles	Day	(mi)	(mi)	CO	NOx	PM10	PM2.5		VOC	CO2	CH4		Formaldehyde		Toluene	Xylene
Fuel tanker	HDDV	5	1	1	6	30	1.13	0.43	na	na	0.001	0.32	112	0.0046	0.0029	0.0007	0.0006	0.0002	0.0002
Logging truck	HDDV	2	1	1	6	12	0.45	0.17	na	na	0.000	0.13	45	0.0019	0.0011	0.0003	0.0002	0.0001	0.000
Cementer truck	HDDV	2	1	1	6	12	0.45	0.17	na	na	0.000	0.13	45	0.0019	0.0011	0.0003	0.0002	0.0001	0.000
Cement supply truck	HDDV	2	2	1	6	24	0.90	0.34	na	na	0.001	0.26	90	0.0037	0.0023	0.0006	0.0004	0.0002	0.000
Casing crew	HDDV	2	1	1	6	12	0.45	0.17	na	na	0.000	0.13	45	0.0019	0.0011	0.0003	0.0002	0.0001	0.000

na

na

na

0.000

0.009

na

na

0.04

0.05

na

0.13

4.72

0.10

2.90

0.83

0.64

10

45

1.664

30

901

485

224.87

3,687

0.0019

0.0688

0.0023

0.0692

0.1746

0.01

0.34

0.0011

0.0423

0.0067

0.1978

0.0794

0.01

0.34

0.0003

0.0105

0.0038

0.1118

0.0125

0.00

0.14

0.0002

0.0083

0.0020

0.0579

0.0222

0.00

0.09

0.0001

0.0036

0.0005

0.0145

0.0054

0.00

0.03

0.0001

0.0025

0.0003

0.0102

0.0038

0.00

0.02

Notes:

Laydown machine

access) - Gas

TOTAL (POUNDS)

Rig hauler

Water truck (100 BBL)

Light duty vehicles (trips for bits)

Light duty vehicles (employee access) - Diesel

Light duty vehicles (employee

Table 5.6

AP-42, Volume II - Mobile Sources, Appendix H, "Heavy Duty Diesel Trucks" high altitude, "aged" with 50,000 miles service, 2001+ model year (EPA 1995).

2

6

² AP-42, Volume II - Mobile Sources, Appendix H, "Light Duty Diesel Trucks" high altitude, "aged" with 50,000 miles service, 1990+ model year for NOx, 1984+ model year for CO and HC (EPA 1995).

12

60

1,776

666

60

0.45

16.70

0.33

9.91

14.18

2.26

- 3 AP-42, Volume II Mobile Sources, Appendix H, "Light Duty Gasoline Trucks I" high altitude, "aged" with 50,000 miles service, 1998+ model year (EPA 1995).
- ⁴ PM2.5 emissions assumed equal to PM10 emissions

HDDV

HDDV

LDDV

LDDV

LDGV

HDDV

37

37

37

⁵ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry, Table 4-11 (HDDV diesel non-semi truck, LDGT average gasoline car, LDDV large diesel car), CO2 Mobile Source Emission Factors, American Petroleum Institute (2004).

0.17

6.35

0.16

4.62

0.96

0.86

- 6 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry for CH4, Table 4-9 (HDDV moderate control, LDGT oxidation catalyst, LDDT moderate control), Mobile Source Combustion Emission Factors, Table 4-10 (HDDV Diesel heavy truck, LDGT Gasoline light truck, LDDT Diesel light truck), Default Fuel Economy Factors for Different Types of Mobile Sources, American Petroleum Institute (2004).
- Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry for N2O, Table 4-9 (HDDV moderate control, LDGT oxidation catalyst, LDDT moderate control), Mobile Source Combustion Emission Factors, Table 4-10 (HDDV Diesel heavy truck, LDGT Gasoline light truck, LDDT Diesel light truck), Default Fuel Economy Factors for Different Types of Mobile Sources, American Petroleum Institute (2004).
- ⁸ AP-42, Section 3.3, "Gasoline and Diesel Industrial Engines. Table 3.3-2, "Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines"
- ⁹ For light duty vehicles (pickup trucks), 60 percent would be diesel-powered, and 40 percent would be gas.
- 10 Well Construction total of 37 days assumed on location: 2 days for rig move, 2 days to rig up, 30 days drilling, 3 days rig down

3

11 Included in the Pollutant Emissions is the Ultra Low Sulfur adjustment based on 15 ppm Ultra Low Sulfur diesel fuel sulfur content compared to 500 ppm (0.05 percent) #2 diesel fuel sulfur content (15 / 500 = 0.03)

Table 5.7								
Emission Source:	WELL CONSTUCT	ION - DRILLING E	NGINES EMISS	IONS - Tier 2				
Emission Equation:	Emissions (lb/well)	= EF (g/hp-hr) x To	tal Haraanawar	(ba) v I E v Drillin	a Duration (days	/wall) v Drilling D	uration (bra/da) / 452 50 g/lb
Emission Equation.	Emissions (ib/weii)	= EF (g/IIp-III) X 10	nai Hoisepowei	(IIP) X LF X DIIIIII	ig Duration (days)	well) x Dillillig D	uration (1115/ua	.y) / 455.59 g/lb
	Pollutant	Total Horsepower		Drilling Activity	Drilling Activity			
	Emission Factor ¹	All Engines ²	Overall Load	Duration	Duration	Emissions	Emissions	
Pollutant	(g/hp-hr)	(hp)	Factor	(days/well)	(hrs/day)	(lb/well)	(lb/hr/well)	
CO	2.60	4,450	0.40	30	24	7,346.19	10.20	
NO _x ³	3.80	4,450	0.40	30	24	10,736.74	14.91	
SO ₂ ⁴	0.0279	4,450	0.40	30	24	78.82	0.11	
VOC	1.00	4,450	0.40	30	24	2,825.46	3.92	
PM ₁₀	0.15	4,450	0.40	30	24	423.82	0.59	
PM _{2.5} ⁵	0.15	4,450	0.40	30	24	423.82	0.59	
CO ₂ ⁶	521.63	4,450	0.40	30	24	1,473,840.00	2,047.00	
CH ₄ ⁷	2.52E-02	4,450	0.40	30	24	71.09	0.10	
N ₂ O ⁸	1.55E-02	4,450	0.40	30	24	43.75	0.06	
Formaldehyde ⁹	3.75E-03	4,450	0.40	30	24	10.59	0.01	
Benzene ⁹	2.96E-03	4,450	0.40	30	24	8.37	0.01	
Toluene ⁹	1.30E-03	4,450	0.40	30	24	3.67	0.01	
Xylene ⁹	9.05E-04	4,450	0.40	30	24	2.56	0.00	Ì
•		,						
Notes:								
¹ Emission factors for T Oct. 23, 1998) for engi 3 Nonroad Diesel Engi	•	np and from Diesel N	Net, Emissions	Standards: USA:	Nonroad Diesel B	ngines, Table 1,	,	
2 Drilling engine total ho	orsepower is based on	two 1,500, two 600	, and one 250 h	p engine, fueled v	with ultra low sulf	ur diesel fuel (15	ppm).	
³ For Tier 2 engines, the assume 3.8 g/bhp-hr fo		•	d NOx emission	rate is 4.8 g/bhp	-hr. Emission ca	lculations preser	nted here	
⁴ AP-42 (EPA 1996), S Industrial Engines". E ppm).			•					
PM _{2.5} assumed equiv	alent to PM ₁₀ for drilling	g engines.						
⁶ AP-42 (EPA 1996), S Industrial Engines"; lb/				3.3-1, "Emission	n Factors for Unc	ontrolled Gasolin	e and Diesel	
⁷ Based on methane er GHG Emission Method	missions of 0.13 g/L of dologies for the Oil and	,	, ,	L and heating val	ue of 19,300 Btu/	lb) from the "Cor	npendium of	
Based on nitrous oxid	le emissions of 0.08 g Emission Methodolog	,	,		g value of 19,300	Btu/lb) from the		
Compendium of Cric								

Table 5.8									
Emission Source:	WELL CONSTUCT	ION - DRILLING E	NGINES EMISS	IONS - Tier 4a (2011)				
F	F:: (II- (II)	FF (/b b) T-		(h) I E D.: II:	- Done George	/II) D-:III D		450.50 m/lb	
Emission Equation:	Emissions (ID/Well)	= EF (g/np-nr) x 10	tai Horsepower	(np) x LF x Drillir	ig Duration (days)	weii) x Driiling D	uration (nrs/day) /	453.59 g/lb	
	Pollutant	Total Horsepower		Drilling Activity	Drilling Activity				
	Emission Factor ¹	All Engines ²	Overall Load	Duration	Duration	Emissions	Emissions		
Pollutant	(g/hp-hr)	(hp)	Factor	(days/well)	(hrs/day)	(lb/well)	(lb/hr/well)		
CO	2.60	4,450	0.40	30	24	7,346.19	10.20		
NO _x	2.60	4,450	0.40	30	24	7,346.19	10.20		
SO ₂ ³	0.0279	4,450	0.40	30	24	78.82	0.11		
VOC	0.30	4,450	0.40	30	24	847.64	1.18		
PM ₁₀	0.075	4,450	0.40	30	24	211.91	0.29		
PM _{2.5} ⁴	0.075	4,450	0.40	30	24	211.91	0.29		
CO ₂ ⁵	521.63	4,450	0.40	30	24	1,473,840.00	2,047.00		
CH₄ ⁶	2.52E-02	4,450	0.40	30	24	71.09	0.10		
N_2O^7	1.55E-02	4,450	0.40	30	24	43.75	0.06		
Formaldehyde ⁸	3.75E-03	4,450	0.40	30	24	10.59	0.01		
Benzene ⁸	2.96E-03	4,450	0.40	30	24	8.37	0.01		
Toluene ⁸	1.30E-03	4,450	0.40	30	24	3.67	0.01		
Xylene ⁸	9.05E-04	4,450	0.40	30	24	2.56	0.00		
•									
Notes:									
¹ Emission factors for	Tier 4 engines taker	from "Control of En	missions of Air I	Pollution From No	nroad Diesel Eng	gines and Fuel" (69 FR 38980,		
June 29, 2004) for en	•	•					oad Diesel		
Engines, Table 4, "Ef		•	Above 560 kW	, g/kWh (g/bhp-h	r)." Available on-	line at			
http://www.dieselnet.							· \		
² Drilling engine total h	•						` /		
³ AP-42 (EPA 1996), \$			•						
Diesel Industrial Engi	nes". Emission rate	of 0.00205 lb/hp-hi	converts to 0.0	279 g/hp-hr when	converting units	and adjusting for	ultra-low		
sulfur fuel (15 ppm).									
⁴ PM _{2.5} assumed equi			odal Facility T	-1-1-004 "" :	F	h	- Para and		
⁵ AP-42 (EPA 1996), \$			•		sion Factors for C	Incontrolled Gas	oline and		
Diesel Industrial Engi Based on methane e			•		value of 10 200 E	Stu/lb) from the "1	Compondium		
of GHG Emission Me	•	•	•		value 01 19,300 E	otu/ω) ποιπ της τ	Compendium		
Based on nitrous oxi		•		•	nting value of 19.3	800 Btu/lh) from t	he		
"Compendium of GH0						oo baanbi nom t			
⁸ AP-42 (EPA 1996), 3			•	•		mpound Emissio	n Factors for		
	Engines", converted f								
Onloon thomas Diocoti L				arorago pranto op	bonno naon bonnoam	iption (Boi o) or	1,000 Blainp		

Emission Source: WELL CONSTRUCTION - DRILLING ENGINES EMISSIONS - Tier 4b (2015)

Table 5.9

Emission Equation:	Emissions (lb/well)	= EF (g/hp-hr) x To	tal Horsepower	(hp) x LF x Drillin	ng Duration (days	/well) x Drilling D	Duration (hrs/da	ay) / 453.59 g
	Pollutant	Total Horsepower		Drilling Activity	Drilling Activity			
	Emission Factor ¹	All Engines ²	Overall Load	Duration	Duration	Emissions	Emissions	
Pollutant	(g/hp-hr)	(hp)	Factor	(days/well)	(hrs/day)	(lb/well)	(lb/hr/well)	
CO	2.60	4,450	0.40	30	24	7,346.19	10.20	
NO _x	2.60	4,450	0.40	30	24	7,346.19	10.20	
SO ₂ ³	0.0279	4,450	0.40	30	24	78.82	0.11	
VOC	0.14	4,450	0.40	30	24	395.56	0.55	
PM ₁₀	0.022	4,450	0.40	30	24	62.16	0.09	
PM _{2.5} ⁴	0.022	4,450	0.40	30	24	62.16	0.09	
CO ₂ ⁵	521.63	4,450	0.40	30	24	1,473,840.00	2,047.00	
CH₄ ⁶	2.52E-02	4,450	0.40	30	24	71.09	0.10	
N₂O ⁷	1.55E-02	4,450	0.40	30	24	43.75	0.06	
Formaldehyde ⁸	3.75E-03	4,450	0.40	30	24	10.59	0.01	
Benzene ⁸	2.96E-03	4,450	0.40	30	24	8.37	0.01	
Toluene ⁸	1.30E-03	4,450	0.40	30	24	3.67	0.01	
Xylene ⁸	9.05E-04	4,450	0.40	30	24	2.56	0.00	
Notes:								
¹ Emission factors for (69 FR 38980, June 2 Nonroad Diesel Engin http://www.dieselnet.c	9, 2004) for engines les, Table 4, "EPA	used in generator s Fier 4 Emission Star	sets greater than	n 1,200 hp and fro	om Diesel Net, Ei	missions Standa	rds: USA:	
² Drilling engine total h	orsepower is based	l on two 1,500, two	600, and one 25	60 hp engine, fuel	ed with ultra low	sulfur diesel fuel	(15 ppm).	
³ AP-42 (EPA 1996), S Diesel Industrial Engii sulfur fuel (15 ppm).			0	,				
⁴ PM _{2.5} assumed equi [,]	valent to PM ₁₀ for di	rilling engines.						
⁵ AP-42 (EPA 1996), S					sion Factors for l	Jncontrolled Gas	oline and	
Diesel Industrial Engir			•	• •				
⁶ Based on methane e	emissions of 0.13 g/l	L of diesel fuel (dies	el density of 850	0 g/L and heating	value of 19.300 E	Btu/lb) from the "	Compendium	

Based on nitrous oxide emissions of 0.08 g/L of diesel fuel (diesel density of 850 g/L and heating value of 19,300 Btu/lb) from the

⁸AP-42 (EPA 1996), Section 3.3, "Gasoline and Diesel Industrial Engines. Table 3.3-2, "Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines", converted from lb/MMBtu to lb/hp-hr using an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-

of GHG Emission Methodologies for the Oil and Gas Industry," Table 4-9 (2004).

"Compendium of GHG Emission Methodologies for the Oil and Gas Industry," Table 4-9 (2004).

WELL COMPL AP-42, Section "Natural Gas Co			RING EMISSION	ONS	
	1.4 (EPA 1998				
	1.4 (EPA 1998				
"Natural Gas Co		8)			
	mbustion"				
Emissions (TP)	/) = Average g	as emitted (M	Mscf) x EF (lb/l	MMscf) / 2000	lbs
, ,		MMscf			
100% flared, 0%	6 vented				
			Llough		
			•		
	Emissions	Duration ²			
lb/MMccf ²			•		
	/	/			
-					
1.4					
· · · · · · · · · · · · · · · · · · ·					
		-			
1.012+00	7.20L-01	70	1.016-02		
d equal to PM10	emissions				
lavs of flaring bef	ore going to sa	ales			
acyc of harring bot	oro going to se	2100			
	Average gas emitted (per well) = 100% flared, 0% flared	Average gas emitted (per well) = 0.4 100% flared, 0% vented	Average gas emitted (per well) = 0.4 MMscf 100% flared, 0% vented Duration	Average gas emitted (per well) = 0.4 MMscf 100% flared, 0% vented	emitted (per well) = 0.4 MMscf Hourly Emissions per Well (lb/m/well) 84 33.6 48 0.70 100 40 48 0.83 7.6 3.04 48 0.06 7.6 3.04 48 0.06 0.6 0.24 48 0.01 5.5 2.2 48 0.05 120,000 48000 48 1000.00 2.3 0.92 48 0.02 2.2 0.88 48 0.02 2.10E-03 8.40E-04 48 1.75E-05 3.40E-03 1.36E-03 48 2.83E-05 1.81E+00 7.23E-01 48 1.51E-02

		Nat	ural Gas Analys	is		
•		Volumetric	Molecular	Gas	Weight	
Gas Component		Concentration	Weight	Weight	Percent	Weight ²
		mol%	(lb/lb-mol)	(lb/lb/mol)	wt %	(lb/MMscf)
Carbon Dioxid	de CO 2:	1.49	43.99	0.65	1.63	691.35
Nitrogen	N 2:	0.58	28.02	0.16	0.40	171.02
Hydrogen Sulf	ide H 2s:	0.00	34.06	0.00	0.00	0.00
Methane	C1:	67.48	16.04	10.82	26.93	11,435.41
Ethane	C2:	13.68	30.07	4.11	10.23	4,344.78
Non-Reactive, no	n-HAP	83.23	152.18	15.75	39.20	16,642.57
Propane	C3:	10.88	44.10	4.80	11.94	5,071.19
Iso-Butane	IC4:	1.07	58.12	0.62	1.55	659.50
Nor-Butane	NC4:	2.94	58.12	1.71	4.26	1,807.91
Iso-Pentane	IC5:	0.54	72.15	0.39	0.97	412.79
Nor-Pentane	NC5:	0.62	72.15	0.45	1.12	473.57
Hexane Plus	C6+:	0.71	100.21	0.71	1.77	749.89
React	ive VOC	16.77	404.85	8.68	21.61	9,174.86
	Totals	100.00		40.19	100.00	42,460.00

¹ Gas analysis from Jackson County, CO 11/21/07

² Gas density is 0.04246 lb/scf (19.26 g/scf) - Need to determine gas density for sample being used

Table 5.11										
Emission	Source:	WASTE POND	EV.	APORAT	ION					
Emission	Factor From:	CDPHE-APCD	- ba	sed on te	ests cond	ducted by	Williams	E&P		
Emission	Factor Equation	Emissions (TP	Y) =	lbs VOC/	bbl x bbl	water to	waste pit	/ 2000 I	bs	
	Emission									
	Factor ¹									
Barrels	(lbs VOC/bbl)	Emissions (lb/v	vell)							
10,000	0.07	700								
¹ Based or	n test conducted	by Williams F&	P fo	r CDPHF	-APCD					
	nd a better emis	•	. 10	. 921112	7 02					
(1122010										

Table 5.12														
Emission Source:	WELL COMP	LETION AND	TESTING - \	EHICLE ROA	D DUST E	MISSIONS								
Emission Factor From:	AP-42, Section													
	"Unpaved Roa	ıds" – Industri	ial roads											
Emission Factor Equation:	E = k x (s/12)) ^a x (W/3) ^b												
Where:	E =	Size-specific	emission fact	or (lb/VMT)										
	S =	Surface mate	erial silt conter	nt (%)										
	W =	Mean vehicle	weight (tons)											
	k =	Empirical co	nstant, particle	e size multiplie	er									
	a =	Empirical co	nstant											
	b =	Empirical co	nstant											
Data:	k =		for PM10											
	k =		for PM2.5	D140 5										
	a=		for PM10 and											
	b=	0.45	for PM10 and	PM2.5										
				T-1-1			Vehicle Miles		DM440	DM0.5	I I a a a a facilità d	I I a a a desilla d	0	0 1 11 1
	Nousbaras			Total	Mean	Silt			PM10	PM2.5			Controlled	Controlled PM2.5
	Number of			Number of	Vehicle		Travelled per		Emission	Emission	PM10	PM2.5	PM10	
Vehicle	Round Trips	Days on	Number of	Round Trips	Weight	Content ¹	Vehicle	Control	Factor (lb/VMT)	Factor	Emissions	Emissions	Emissions	Emissions
	per Day	Location	Vehicles	(per year?) 24	(tons)	(%) 24	(VMT/vehicle)	Efficiency	8.98	(lb/VMT) 0.90	(lbs/pad)	(lbs/pad) 129	(lbs/pad) 1034	(lbs/pad)
Casing hauler	6	1		24		24	6	80%			1293	7		103 5
Completion rig	1		1	1	61.5		-	80%	10.90	1.09 0.74	65 178	18	52 142	
Logging truck Sand truck	3	2 5	1	4 15	26 40	24 24	6	80% 80%	7.40 8.98	0.74	808	81	647	14 65
	1	2	13	26	40	24	6	80%	8.98	0.90	1401	140	1121	112
Frac pumper Fracmaster delivery	1		2	4	40	24	6	80%	8.98	0.90	216	22	172	17
-	3	2 5	1		40		6		8.98		-	81	647	
Water truck (road dust control) Light duty vehicles (employee	3	5	1	15	40	24	0	80%	0.98	0.90	808	01	647	65
access)	2	10	6	120	4.6	24	6	80%	3.39	0.34	2443	244	1954	195
Water truck - frac water	12	8	2	192	4.6	24	6	80%	8.98	0.34	10344	1034	8275	828
TOTAL	12	U		132	40		. 0	OU /0	0.90	0.90	10344	1034	14044	1404
IOIAL													17044	1404
¹ Silt content from AP-42 Table ²	12 2 2 1 for a fe	achly graded	haul road											
Sill Content horn AP-42 Table	13.2.2-1 101 a 116	estily graded	naui ioau.											

Table 5.13																			
Emission Source:	WELL COM	PLETION AN	ND TESTING	- VEHICLE E	XHAUST EMI	SSIONS													
Emission Equation:	Emissions (1	PY) = grams	s/VMT x VN	IT / 453.59 gra	ms / 2000 lbs														
						/	n.a.=123												-
						ion Factors (g		26	7	I	_ 0	0	0	1					
Equipment	CO	NOx	PM10	PM2.5 ⁴	SO2	VOC	CO2 ⁵	CH4 ⁶	N2O ⁷	Formaldehyde ⁸	Benzene ⁸	Toluene ⁸	Xylene ⁸	ļ					
HD Diesel Engine Trucks																			
(HDDV)	17.06	6.49	n/a	n/a	0.32	4.82	1700	0.07028112	0.0432	0.0107	0.0085	0.00371	0.0026						
LD Diesel Trucks (60																			
percent)9 (LDDV)	2.53	1.18	n/a	n/a	n/a	0.74	230	0.01768291	0.0505	0.0286	0.0148	0.00371	0.0026						
LD Gas Trucks (40																			
percent) (LDGV)	9.659	0.651	n/a	n/a	n/a	0.562	330	0.11893728	0.0541	0.0085	0.0151	0.00371	0.0026						
	01	Days on	# of	Number of	Round Trip Distance	VMT					Polit	tant Emission	ns (lbs/well	pad)					
Equipment	Class of Vehicle	Location ¹⁰	# or Vehicles	Round Trips Per Day	(mi)	(mi)	со	NOx	PM10	PM2.5	SO2 ¹¹	VOC	CO2	CH4	N2O	Formaldehyde	Benzene	Toluene	Xylene
Casing hauler	HDDV	4	1	6	6	144	5	2	na	na Fiviz.5	0.003	2	540	0.022	0.014	0.003	0.003	0.001	0.001
Completion rig	HDDV	1	1	1	6	6	0	0	na	na	0.000	0	22	0.022	0.001	0.000	0.000	0.000	0.000
Logging truck	HDDV	2		2	6	24	1	0	na	na	0.001	0	90	0.004	0.002	0.001	0.000	0.000	0.000
Sand truck	HDDV	5	1	3	6	90	3	1	na	na	0.002	1	337	0.014	0.002	0.002	0.002	0.001	0.001
Frac pumper	HDDV	2	13	1	6	156	6	2	na	na	0.003	2	585	0.024	0.015	0.004	0.003	0.001	0.001
Fracmaster delivery	HDDV	2	2	1	6	24	1	0	na	na	0.001	0	90	0.004	0.002	0.001	0.000	0.000	0.000
Water truck (road dust					-														
control)	HDDV	5	1	3	6	90	3	1	na	na	0.002	1	337	0.014	0.009	0.002	0.002	0.001	0.001
Light duty vehicles																			
(employee access) -																			
Diesel	LDDV	10	4	2	6	480	3	1	na	na	na	1	243	0.019	0.053	0.030	0.016	0.004	0.003
Light duty vehicles																			
(employee access) - Gas	LDGV	10	2	2	6	240	5	0	na	na	na	0	175	0.063	0.029	0.004	0.008	0.002	0.001
Water truck - frac water																			
130 BBL	HDDV	8	2	12	6	1,152	43	16	na	na	0.024	12	4,318	0.178	0.110	0.027	0.022	0.009	0.007
TOTAL (POUNDS)							71	26	0	0	0.04	19	6,737	0.34	0.24	0.07	0.06	0.02	0.01
Notes:																			
	Courses Ann	ondiv II "II	sau Dutu D	ioool Tayoko" b	iah altituda "a	and" with FO	000 miles ser	iaa 2001 i ma	dal veer (FD	A 100E)									
AP-42, Volume II - Mobile						•			- ' '			1110 (504	1005)						
AP-42, Volume II - Mobile											year for CO a	nd HC (EPA	1995).						
AP-42, Volume II - Mobile							0,000 miles :	serисе, 1998+ г	model year (I	=PA 1995).		1				1			
PM2.5 emissions assume			•																
5 Compendium of Greenhou																			
⁶ Compendium of Greenhout											moderate con	trol), Mobile S	Source Com	bustion Em	ission Fac	tors, Table 4-10	(HDDV Die	sel heavy t	ruck,
LDGT Gasoline light truck,																			
Compendium of Greenhout											moderate cor	trol), Mobile S	Source Com	bustion En	nission Fac	tors, Table 4-10	(HDDV Die	sel heavy t	ruck,
LDGT Gasoline light truck,		0 ,.																	
8 AP-42, Section 3.3, "Gas							Emission Fac	ctors for Uncont	rolled Diesel	Engines"			_						
⁹ For light duty vehicles (pid		•																	
Well Completion and Tes																			
¹¹ Included in the Pollutant	Emissions is	the Ultra Lov	v Sulfur adju	stment based	on 15 ppm Ult	ra Low Sulfur	diesel fuel su	ılfur content cor	npared to 50	0 ppm (0.05 perc	ent) #2 diesel	fuel sulfur cor	ntent (15 / 5	600 = 0.03).					

Emission Factor From: AP-42, Section 3.3 (EPA 1996) "Gasoline and Diesel Industrial Engines" Emission Equation: Emissions (Ib/well) = grams/hp-hr x hrs of use x Load Factor x hp / 453.59 grams Data: Engine Horsepower: Q200 hp Operating Load Factor: 0.6 Duration (hours) ² : 84 hours Emission Factors g/hp-hr (Ibs/well pad)	Table 5.14			
"Gasoline and Diesel Industrial Engines" Emission Equation: Emissions (lb/well) = grams/hp-hr x hrs of use x Load Factor x hp / 453.59 grams Data: Engine Horsepower: 0.6	Emission Source:	COMPLETION - FRAC	PUMP ENGINE	S
"Gasoline and Diesel Industrial Engines" Emission Equation: Emissions (lb/well) = grams/hp-hr x hrs of use x Load Factor x hp / 453.59 grams Data: Engine Horsepower: 0.6				
Emission Equation: Emissions (lb/well) = grams/hp-hr x hrs of use x Load Factor x hp / 453.59 grams Data: Engine Horsepower: Operating Load Factor: Operation	Emission Factor From:			
Engine Horsepower: 2200 hp Operating Load Factor: 0.6 Ouration (hours) ² : 84 hours		"Gasoline and Diesel Inc	dustrial Engines	"
Engine Horsepower: 2200 hp Operating Load Factor: 0.6 Ouration (hours) ² : 84 hours				
Operating Load Factor: 0.6	Emission Equation:	Emissions (lb/well) = gra	ams/hp-hr x hrs	of use x Load Factor x hp / 453.59 grams
Operating Load Factor: 0.6 Duration (hours) ² : 84 hours	Doto	Engine Hereenewer:	2200	ho
Duration (hours) ² : 84 hours	Data:			
Emission Factors Emissions (lbs/well pad)				
Factors g/hp-hr (lbs/well pad) CO 3.03E+00 740.68 NOx 14.06129 3437.28 PM ₁₀ 9.98E-01 243.94 PM _{2.5} 9.98E-01 227.30 PM _{2.5} 227.30		Duration (nours) :	84	nours
Factors g/hp-hr (lbs/well pad) CO 3.03E+00 740.68 NOx 14.06129 3437.28 PM ₁₀ 9.98E-01 243.94 PM _{2.5} 9.98E-01 227.30 PM _{2.5} 227.30		Fmission		
Pollutant g/hp-hr (lbs/well pad) CO 3.03E+00 740.68 NOx 14.06129 3437.28 PM ₁₀ 9.98E-01 243.94 PM _{2.5}			Fmissions	
CO 3.03E+00 740.68 NOx 14.06129 3437.28 PM ₁₀ 9.98E-01 243.94 PM _{2.5} ¹ 9.98E-01 243.94 SO ₂ 9.30E-01 227.30 VOC 1.14E+00 278.76 CO2 521.63 127512.00 CH ₄ ³ 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM _{2.5} emissions assumed equal to PM ₁₀ emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	Pollutant			
NOx 14.06129 3437.28 PM ₁₀ 9.98E-01 243.94 PM _{2.5} ¹ 9.98E-01 243.94 SO ₂ 9.30E-01 227.30 VOC 1.14E+00 278.76 CO2 521.63 127512.00 CH ₄ ³ 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM _{2.5} emissions assumed equal to PM ₁₀ emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	CO	<u> </u>		
PM _{2.5} ¹ 9.98E-01 243.94 SO ₂ 9.30E-01 227.30 VOC 1.14E+00 278.76 CO2 521.63 127512.00 CH ₄ ³ 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: ¹ PM _{2.5} emissions assumed equal to PM ₁₀ emissions. ² Assumes 12 hours per day for 14 days. ³ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	NOx	14.06129	3437.28	
SO2 9.30E-01 227.30 VOC 1.14E+00 278.76 CO2 521.63 127512.00 CH ₄ ³ 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: ¹ PM _{2.5} emissions assumed equal to PM ₁₀ emissions. ² Assumes 12 hours per day for 14 days. ³ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	PM ₁₀	9.98E-01	243.94	
VOC 1.14E+00 278.76 CO2 521.63 127512.00 CH ₄ ³ 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM _{2.5} emissions assumed equal to PM ₁₀ emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	PM _{2.5} ¹	9.98E-01	243.94	
CO2 521.63 127512.00 CH ₄ ³ 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM _{2.5} emissions assumed equal to PM ₁₀ emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	SO ₂	9.30E-01	227.30	
CH43 1.16E-01 28.31 Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM2.5 emissions assumed equal to PM10 emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	VOC	1.14E+00	278.76	
Form. 3.75E-03 0.92 Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM _{2.5} emissions assumed equal to PM ₁₀ emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	CO2	521.63	127512.00	
Benzene 2.96E-03 0.72 Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: 1 PM _{2.5} emissions assumed equal to PM ₁₀ emissions. 2 Assumes 12 hours per day for 14 days. 3 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	CH ₄ ³	1.16E-01	28.31	
Toluene 1.30E-03 0.32 Xylene 9.05E-04 0.22 Notes: PM _{2.5} emissions assumed equal to PM ₁₀ emissions. Assumes 12 hours per day for 14 days. Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	Form.	3.75E-03	0.92	
Notes: PM _{2.5} emissions assumed equal to PM ₁₀ emissions. Assumes 12 hours per day for 14 days. Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	Benzene	2.96E-03	0.72	
Notes: ¹ PM _{2.5} emissions assumed equal to PM ₁₀ emissions. ² Assumes 12 hours per day for 14 days. ³ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	Toluene			
¹ PM _{2.5} emissions assumed equal to PM ₁₀ emissions. ² Assumes 12 hours per day for 14 days. ³ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	Xylene	9.05E-04	0.22	
¹ PM _{2.5} emissions assumed equal to PM ₁₀ emissions. ² Assumes 12 hours per day for 14 days. ³ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	Notes:			
Assumes 12 hours per day for 14 days. Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5		ed equal to PM ₁₀ emission	ns.	
³ Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry Table 4-5	=			
	·	•	dologies for the	Oil and Gas Industry Table 4-5
	•			and the modern radio is

Table 5.15											
Emission Source:	PRODUCTION - HEATER/T	REATER EMIS	SIONS								
Emission Factor From:	AP-42, Section 1.4 (EPA 19	998)									
	"Natural Gas Combustion"	,									
Emission Equation:	Emissions (TPY) = Emission	n Factor (lbs/N	//Mscf) x Fuel H	eating Value	(Btu/scf)	K Heat Rate	(MMBtu/h) x Hours o	of Operation	(hrs/yr) /	2000 lbs
Data:	Fuel Heating Value =	1020	Btu/scf								
	Heat Rate =	0.5	MMBtu/hr								
	Hours of Operation =	8760	hrs/yr								
Assumptions:	500K BTU/hr heater/treater;	Operates year	round								
	Emission Factor ¹	Emissions	Emissions								
Pollutant	(lb/MMscf)	(lb/hr)	(lb/well pad)								
CO	84	0.04	360.71								
NOx	100	0.05	429.41								
PM10	7.6	0.00	32.64								
PM2.5	7.6	3.73E-03	32.64								
SO2	0.6	0.00	2.58								
VOC	5.5	2.70E-03	23.62								
CO2	120000	58.82	515,294.12								
CH4	2.3	0.00	9.88								
N2O	2.2	0.00	9.45								
Formaldehyde	0.075	0.00	0.32								
Benzene	0.0021	0.00	0.01								
Ethylbenzene	NA	NA	NA								
Toluene	0.0034	0.00	0.01								
Xylene	NA	NA	NA								

Table 5.16						
Emission Source:	PRODUCTION - \	WELL PAD TAN	NKS			
Emission Factor From:	APCD's PS Mem	o 05-01 docume	ent, Section 4.1	for remainder of Co	olorado	
Assumptions:	4 - 400 bbl Conde	nsate Tanks				
	2 - 400 bbl Produc	ced Water Tank	s ¹			
	Condensate Throu	ıghput:	150	bbl/day/pad		
Data:	Condensate Throu	ughput:	4500	bbl/month/pad		
	Condensate Throu	ughput:	54000	bbl/year/pad		
	Control efficiency	2 (%):	95%			
		Uncontrolled	Controlled		Uncontrolled	Controlled
	Emission Factor	Emissions	Emissions ²	Emissions	Emissions	Emissions
Pollutant	(lbs/bbl)	(lb/pad)	(lb/pad)	(lb/hr)	(tons/yr)	(tons/yr)
VOC	11.8	637,200.00	31,860.00	72.74	318.60	15.93
Benzene	0.034	1,836.00	91.80	0.21	0.92	0.92
n-Hexane	0.185	9,990.00	499.50	1.14	5.00	5.00
Notes:						
1 Produced water tanks are	e assumed to have r	ninimal emissio	ns and they are	not quantified.		
Assumed to have 95% co	ntrol based on (CPD	HE 2007) Regu	lation 7 "Emissi	ions of Volatile Org	ganic Compounds (5	CCR 1001-9)"
Effective Statewide Ma	ay 1, 2008 (CPDHE 2	2007 Reg 7, Se	c XVII)			
95 percent on Condens	sate Tank (with unco	ontrolled VOC er	missions >20 TI	PY)		

Emission Source:	PRODUCTION - GAS GENER	ATOP1			
Lillission Source.	FRODUCTION - GAS GENE	KATOK			
Emission Factor From:	AP-42, Section 3.2 (EPA 200	0)			
	"Natural Gas-fired Reciprocati	ing Engines"			
Assumptions:	Gas Generator Power:	25	kW		
	Horsepower:	33.5	hp		
	Heat Rate:	0.0853	MMBtu/hr		
Emission Equation:	Emissions (lb/hr) = EF (lbs/M	MBtu) x MMBtu	u/hr x 8760 hrs /	2000 lbs	
	Emission Factor	Emissions	Emissions	Emissions	Emissions
Pollutant	(lb/MMBtu)	(lb/hr)	(lb/yr)	(tons/yr)	(lb/well)
CO	3.17E-01	2.70E-02	236.87	0.12	236.87
NO _x	4.08	3.48E-01	3,048.69	1.52	3,048.69
SO ₂	5.88E-04	5.02E-05	0.44	0.00	0.44
PM ₁₀	7.71E-05	6.58E-06	0.06	0.00	0.06
PM _{2.5}	7.71E-05	6.58E-06	0.06	0.00	0.06
CO ₂	1.10E+02	9.38E+00	82,195.08	41.10	82,195.08
Benzene	4.40E-04	3.75E-05	0.33	0.00	0.33
Ethylbenzene	3.97E-05	3.39E-06	0.03	0.00	0.03
Form.	5.52E-02	4.71E-03	41.25	0.02	41.25
Hexane	4.45E-04	3.80E-05	0.33	0.00	0.33
Toluene	4.08E-04	3.48E-05	0.30	0.00	0.30
Xylene	1.84E-04	1.57E-05	0.14	0.00	0.14

Table 5.	.18							
Emissio	n Source:	PRODUCTION	N - WIND EROS	SION				
Emission	n Factor From:		-008 (EPA 199					
		"Control of Fu	gitive Dust Sou	rces"				
Emissio	n Equation:	TSD (lb/acro/r	nonth) = 1 7 x /	(s/1.5) x ([365-p]/23	25\ v (f/15\			
LIIIISSIUI	iii Equation.			sturbed acreage x 1) lhe		
		LIIII33IOII3 (II	1) = 131 X dis	stuibed acreage x	12 111011(113 / 2000	7 103		
Where:		s =	silt content (pe	ercent)				
				s with >.001 in pred	cipitation (not us	sed)		
				wind speed >5.4 (
Data:		s =		percent silt (avera				
		f =	36.6	percent of time wi				
				from Rock Springs	FAA Airport (W	yoming)1985,	, 1987-1990	
	Distu	irbed acreage=	8	acres				
		TSP =	95.0	(lb/o ovo/m o náb)				
		137 =	65.9	(lb/acre/month)				
Assume	Control Efficiency:		80%	for watering				
	tions per pad/road:			ell pad (assumes 4	acre drill pad, 2	acre road, 2 a	acre other infrastru	ucture)
	•							
			Uncontrolled	Uncontrolled	Controlled			
		Conversion	Emissions	Emissions	Emissions ²			
	Particulate	Factor ¹	(lb/month)	(lb/year)	(lbs/pad/year)			
TSP		na	687.21	8,247	6,597.26			
PM_{10}		0.25	171.80	2,062	1,649.32			
PM _{2.5}		0.15	103.08	1,237	989.59			
Notes:								
¹ PM ₁₀ =	= $0.25*TSP$; $PM_{2.5} = 0$	0.15*PM ₁₀ This	conversion fac	tor came from AP-4	42 13.2.2 backgr	ound docume	nt "Background Γ	Occument for
Revision								
	to Fine Fraction Ratio	s Used for AP-	42 Fugitive Dus	t Emission Factors	s" (2006).			
-	to Fine Fraction Rationes 50% control by wat		42 Fugitive Dus	t Emission Factors	s" (2006).			
-			42 Fugitive Dus	t Emission Factors	8" (2006).			
_	nes 50% control by wat	tering	42 Fugitive Dus	t Emission Factors	" (2006).			
_	nes 50% control by wat	tering 37.82	42 Fugitive Dus	t Emission Factors	" (2006).			
_	nes 50% control by wat 1985 1986	37.82 27.95		t Emission Factors	" (2006).			
_	nes 50% control by wat	37.82 27.95 38.88	42 Fugitive Dus	t Emission Factors	" (2006).			

Table 5.19													
Emission Source:	WELL PRODU	JCTION - VEH	ICLE ROAD D	UST EMISSIO	NS								
Emission Factor From:	AP-42, Section	n 12 2 2 (EDA	3006)										
Ellission Factor From.	"Unpaved Road												
	Unpaved Road	us – iriuustriai	Toaus										
Emission Factor Equation:	$E = k \times (s/12)^{6}$	^a x (W/3) ^b											
Where:	E =	Size-specific e	emission facto	r (lb/VMT)									
	s =	Surface mater	ial silt content	(%)									
	W =	Mean vehicle	weight (tons)										
	k =	Empirical cons	stant, particle	size multiplier									
	a =	Empirical cons	stant										
	b =	Empirical cons	stant										
Data:	k =		for PM10										
	k =		for PM2.5										
	a=		for PM10 and										
	b=	0.45	for PM10 and	PM2.5									
						Vehicle Miles		PM10	PM2.5	Uncontrolled	Uncontrolled	Controlled	Controlled
	Number of		Total		Silt	Travelled per		Emission	Emission	PM10	PM2.5	PM10	PM2.5
	Round Trips	Number of		Mean Vehicle	Content ¹	Vehicle	Control	Factor	Factor	Emissions	Emissions	Emissions	Emissions
Vehicle	per Week	Vehicles		Weight (tons)	(%)	(VMT/vehicle)	Efficiency	(lb/VMT)	(lb/VMT)	(lbs/pad)	(lbs/pad)	(lbs/pad)	(lbs/pad)
Water truck	2	1	104	40	8.4	6	80%	3.49	0.35	2178	218	1743	174
Condensate truck	3	1	156	40	8.4	6	80%	3.49	0.35	3267	327	2614	261
Light duty vehicles (employee access)	7	1	364	46	8.4	6	80%	3.72	0.37	8118	812	6495	649
TOTAL										13564	1356	10851	1085
¹ Silt content from AP-42 Table 13.2.2-1	for a haul road.	(replaced free	shly graded, us	sed for construc	ction, but r	not production!!!)							

truck, LDGT Gasoline light truck, LDDT Diesel light truck), Default Fuel Economy Factors for Different Types of Mobile Sources, American Petroleum Institute (2004).

truck, LDGT Gasoline light truck, LDDT Diesel light truck), Default Fuel Economy Factors for Different Types of Mobile Sources, American Petroleum Institute (2004).

3 AP-42, Section 3.3, "Gasoline and Diesel Industrial Engines. Table 3.3-2, "Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines"

Table 5.20																		
mission Source:	WELL PR	ODUCTION	- VEHICLE	EXHAUST EN	IISSIONS													
Emission Equation:	Emissions	(TDV) = grs	me/\/MT v \	VMT / 453.59	arame / 200	Ω Ibe												
imsaon Equation.	LIIII3310113	(11 1) = gia	IIII NIVIII A	V W 1 7 433.33	giailis / 200	JO 103												
				E	mission Fa	actors (g/VIV	IT) ^{1,2,3}											
Equipment	CO	NOx	PM10	PM2.5 ⁴	SO2	VOC	CO2 ⁵	CH4 ⁶	N2O ⁷	Formaldehyde8	Benzene ⁸	Toluene ⁸	Xylene ⁸					
HD Diesel Engine Trucks																		
(HDDV)	17.06	6.49	n/a	n/a	0.32	4.82	1700	0.070	0.0432	0.0107	0.0085	0.00371	0.0026					
D Diesel Trucks (60																		
percent)9(LDDV)	2.53	1.18	n/a	n/a	n/a	0.74	230	0.018	0.0505	0.0286	0.0148	0.00371	0.0026					
LD Gas Trucks (40 percent)																		
(LDGV)	9.659	0.651	n/a	n/a	n/a	0.562	330	0.119	0.0541	0.0085	0.0151	0.00371	0.0026					
			Number of	Round Trip							Pollutant E	missions (It	s/well pad)					
		Number of	Round	Distance	VMT													
Equipment	Vehicle	Vehicles	Trips Per	(mi)	(mi)	CO	NOx	PM10	PM2.5	SO2 ¹⁰	VOC	CO2	CH4	N2O	Formaldehyde	Benzene	Toluene	Xylene
Water truck (process water																		
removal)	HDDV	1	2	6	624	23.5	8.9	na	na	0.01	7	2,339	0.10	0.06	0.01	0.01	0.01	0.00
Condensate truck (condensate	HDDV		_		000	25.0	40.4			0.00	40	0.500	0.45	0.00	0.00	0.00	0.04	0.04
removal)	HDDV	1	3	6	936	35.2	13.4	na	na	0.02	10	3,508	0.15	0.09	0.02	0.02	0.01	0.01
light duty vehicles (employee access) - Diesel	LDDV	1	7	6	2,184	12.2	5.7	na	na	na	4	1.107	0.09	0.24	0.14	0.07	0.02	0.01
light duty vehicles (employee	LDDV	'	,	0	2,104	12.2	5.7	IIa	Ha	i ia	-	1,107	0.09	0.24	0.14	0.07	0.02	0.01
access) - Gas	LDGV	1	7	6	2.184	46.5	3.1	na	na	na	3	1.589	0.57	0.26	0.04	0.07	0.02	0.01
TOTAL (POUNDS)	2501	<u> </u>		ŭ	2,101	70.9	28.0	0	0	0.03	20	8,543	0.90	0.65	0.22	0.17	0.05	0.03
Notes:																		
AP-42, Volume II - Mobile Sou	rces, Appen	ndix H, "Hea	y Duty Dies	el Trucks" hig	h altitude, "	aged" with 5	0,000 miles	service, 20	01+ model	year (EPA 1995)).							
AP-42, Volume II - Mobile Sou	rces, Apper	ndix H, "Ligh	t Duty Diese	el Trucks" high	altitude, "a	ged" with 50	0,000 miles	service, 199	90+ model y	ear for NOx, 198	34+ model y	ear for CO a	nd HC (EPA	1995).				
AP-42, Volume II - Mobile Sou	rces, Apper	ndix H, "Ligh	t Duty Gaso	line Trucks I"	high altitude	e, "aged" wit	h 50,000 m	les service,	1998+ mod	lel year (EPA 19	95).		,					
PM2.5 emissions assumed eq										. ,								
Compendium of Greenhouse G							DV diesel r	on-semi tru	ick. LDGT a	verage gasoline	car. LDDV la	arge diesel o	ar). CO2 M	obile Sour	ce Emission Fac	ctors. America	n Petroleum	Institute (2
Compendium of Greenhouse G												-	-,-					

7 Compendium of Greenhouse Gas Emission Methodologies for the Oil and Gas Industry for N2O, Table 4-9 (HDDV moderate control, LDGT oxidation catalyst, LDDT moderate control), Mobile Source Combustion Emission Factors, Table 4-10 (HDDV Diesel heavy

10 Included in the Pollutant Emissions is the Ultra Low Sulfur adjustment based on 15 ppm Ultra Low Sulfur diesel fuel sulfur content compared to 500 ppm (0.05 percent) #2 diesel fuel sulfur content (15 / 500 = 0.03).

For light duty vehicles (pickup trucks), 60 percent would be diesel-powered, and 40 percent would be gas.

								9							
					Е	missions by	Source Categor	y (lbs/well)							
Source Type	со	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOCs	Formaldehyde	Benzene	Toluene	Xylene	Ethylbenzene	Hexane	CO ₂	CH₄	N ₂ O
/ell Pad Construction															
General Activity				368.22	55.23										-
Vehicle Road Dust				4,493.57	449.36							-			-
Equipment Exhaust	104.85	342.65	33.76	33.76	1.19	28.49	0.17	0.13	0.06	0.04	-	-	23.506	1.13	0.70
Vehicle Exhaust	27.76	10.30	0.01			7.64	0.02	0.02	0.0065	0.0045	-	-	2,705	0.12	0.0
Subtotal	132.61	352.95	33.77	4,895.55	505.78	36.13	0.19	0.15	0.06	0.05	0.00	0.00	26,211.35	1.26	0.7
/ell Construction	102.01	002.00	00.77	4,000.00	000.70	00.10	0.10	0.10	0.00	0.00	0.00	0.00	20,211100		0.7
Vehicle Road Dust				5.46	0.55										-
Vehicle Road Bust Vehicle Exhaust	47.22	14.40	0.00	0.00	0.05	10.26	0.14	0.09	0.03	0.02		-	3,687	0.34	0.3
Drilling Engines - Tier 2	7.346.19	10.736.74	78.82	423.82	423.82	2.825.46	10.59	8.37	3.67	2.56	-		1,473,840	71.09	43.7
Drilling Engines - Tier 4a (2011)	7,346.19	7,346.19	78.82	211.91	211.91	847.64	10.59	8.37	3.67	2.56	-		1,473,840	71.09	43.7
Drilling Engines - Tier 4a (2011) Drilling Engines - Tier 4b (2015)	7,346.19	7,346.19	78.82	62.16	62.16	395.56	10.59	8.37	3.67	2.56			1,473,840	71.09	43.7
	7,393.41	10,751.15	78.82	429.28	424.42	2,835.72	10.73	8.46	3.69	2.57	0.00	0.00	1,477,526.72	71.43	44.0
completion and Testing															
Flaring	33.60	40.00	0	3.04	3.04	2.20		0.00	0.00			1.81	48,000	0.92	0.8
Waste Pond Evaporation						700.00						-			-
Vehicle Road Dust				14,044.29	1,404.43							-			
Vehicle Exhaust	71.20	25.72	0.04			19.00	0.07	0.06	0.02	0.01			6,737	0.34	0.2
Frac Pump Engines	740.68	3,437.28	227.30	243.94	243.94	278.76	0.92	0.72	0.32	0.22			127,512	28.31	
Subtotal	845.48	3,503.00	227.58	14,291.27	1,651.41	999.96	0.07	0.06	0.02	0.01	0.00	1.81	54,736.92	1.26	1.1
CONSTRUCTION TOTAL ¹	8,371.49	14,607.09	340.17	19,616.09	2,581.60	3,871.81	10.99	8.67	3.78	2.63	0.00	1.81	1,558,474.99	73.95	45.9
/ell Production	_,00	. 1,001.00	3-10.17	.0,0.0.00	_,0000	3,07 1.01		0.07	J	2.00	0.00		.,000,-11.00		
Heater/Treater	360.71	429.41	2.5765	32.6353	32.6353	23.6176	0.32	0.01	0.01	-	-	-	515,294	9.88	9.4
Condensate Tanks	500.77	723.71	2.5705	32.0333	32.0333		0.02	91.80	0.01	-		499.50	313,234	9.00	3.4
Gas Generator	226.07	2 049 60	0.44	0.06	0.06	31,860.00	41.25		0.20	0.14			92.105		
	236.87	3,048.69	0.44	1.649.32		-	41.25	0.33	0.30	0.14	0.03	0.33	82,195		
Wind Blown Dust					989.59	-		-				-			-
Vehicle Road Dust				10,850.98	1,085.10										-
Vehicle Exhaust	70.86	28.00	0.03			20.14	0.22	0.17	0.05	0.03			8,543	0.90	0.6
Subtotal	668.43	3,506.10	3.05	12,532.99	2,107.38	31,903.76	41.78	92.31	0.37	0.17	0.03	499.83	606,032.24	10.78	10.1
PRODUCTION TOTAL	668.43	3,506.10	3.05	12,532.99	2,107.38	31,903.76	41.78	92.31	0.37	0.17	0.03	499.83	606,032.24	10.78	10.1
CONSTRUCTION AND															
PRODUCTION TOTAL	9.039.92	18,113.20	343.22	32,149.08	4.688.98	35,775.57	52.78	100.98	4.15	2.81	0.03	501.64	2,164,507.24	84.73	56.0
lotes: Construction emissions are based on rell pad construction.	a per well c	onstructed/dr	illed basis.	Construction	emissions o	occur only in	the year that a we	ell pad is cons	structed and	associated v	vells are drilled. A	all drilling is a	assumed to be co	empleted in t	ne year
lotes: Construction emissions are based on	a per well c	onstructed/dri	illed basis.	Construction			the year that a we		structed and	associated v	vells are drilled. A	all drilling is a	assumed to be co	empleted in t	ne year
lotes: Construction emissions are based on ell pad construction.					En	nissions by	Source Category	r (tons/well)							
lotes: Construction emissions are based on ell pad construction. Source Type	a per well c	onstructed/dri	illed basis.	Construction				r (tons/well)	structed and	associated v	vells are drilled. A	Ill drilling is a	cO ₂	ompleted in t	
lotes: Construction emissions are based on rell pad construction. Source Type Vell Pad Construction	со	NO _x	SO ₂	PM ₁₀	En	vocs	Source Category	(tons/well) Benzene	Toluene	Xylene	Ethylbenzene	Hexane	CO ₂	CH₄	N ₂ C
lotes: Construction emissions are based on ell pad construction. Source Type Veil Pad Construction General Activity				PM ₁₀	PM _{2.5}	nissions by	Source Category	r (tons/well)							
lotes: Construction emissions are based on rell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust	CO	NO _x	SO ₂	PM ₁₀ 0.1841 2.2468	PM _{2.5} 0.0276 0.2247	VOCs	Source Category Formaldehyde	(tons/well) Benzene	Toluene	Xylene 	Ethylbenzene	Hexane 	CO ₂	CH₄ 	N ₂ C
Iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust	 0.0524	NO _x	SO ₂	PM ₁₀	PM _{2.5}	VOCs 0.0142	Formalde hyde 0.0001	Benzene 0.0001	 0.0000	 0.0000	Ethylbenzene	Hexane 	CO ₂	CH ₄	N ₂ C
totes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust	CO 0.0524 0.0139	NO _x 0.1713 0.0051	SO ₂ 0.0169 0.0000	PM ₁₀ 0.1841 2.2468 0.0169	PM _{2.5} 0.0276 0.2247 0.0006	VOCs 0.0142 0.0038	Formaldehyde 0.0001 0.0000	(tons/well) Benzene 0.0001 0.0000	 0.0000 0.0000	Xylene 0.0000 0.0000	Ethylbenzene	Hexane 	CO ₂ 11.7530 1.3527	CH ₄ 0.0006 0.0001	N ₂ C
iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal	 0.0524	NO _x	SO ₂	PM ₁₀ 0.1841 2.2468	PM _{2.5} 0.0276 0.2247	VOCs 0.0142	Formalde hyde 0.0001	Benzene 0.0001	 0.0000	 0.0000	Ethylbenzene	Hexane 	CO ₂	CH ₄	N ₂ C
totes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Takaust Subtotal Vell Construction	CO 0.0524 0.0139	NO _x 0.1713 0.0051	SO ₂ 0.0169 0.0000 0.0169	PM ₁₀ 0.1841 2.2468 0.0169 2.4478	PM _{2.5} 0.0276 0.2247 0.0006 0.2529	VOCs 0.0142 0.0038	Formaldehyde 0.0001 0.0000	(tons/well) Benzene 0.0001 0.0000		Xylene 0.0000 0.0000	Ethylbenzene	Hexane 0.0000	CO ₂ 11.7530 1.3527	CH ₄ 0.0006 0.0001	N ₂ C
iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Vell Construction Vehicle Road Dust	 0.0524 0.0139 0.0663	NO _x 0.1713 0.0051 0.1765	SO ₂ 0.0169 0.0000 0.0169	PM ₁₀ 0.1841 2.2468 0.0169 2.4478	PM _{2.5} 0.0276 0.2247 0.0006 0.2529	VOCs	Formaldehyde 0.0001 0.0000	Benzene	Toluene 0.0000 0.0000	Xylene 0.0000 0.0000 0.0000	Ethylbenzene	Hexane 0.0000	CO ₂	CH ₄ 0.0006 0.0001 0.0006	N ₂ C
Iotes: Construction emissions are based on ell pad construction. Source Type VelI Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Vehicle Road Dust	CO 0.0524 0.0139 0.0663	NO _x 0.1713 0.0051 0.1765 0.0072	SO ₂ 0.0169 0.0000 0.0169	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000	PM _{2.5} 0.0276 0.2247 0.006 0.2529	VOCs	Formaldehyde 0.0001 0.0001 0.0001	Benzene 0.0001 0.0000 0.0000	Toluene 0.0000 0.0000 0.0000	Xylene	Ethylbenzene	Hexane 0.0000	CO ₂ 11.7530 1.3527 13.1057	CH ₄ 0.0006 0.0001 0.0006	N ₂ C
Lotes: Construction emissions are based on ell pad construction. Source Type Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Fixen Service	CO 0.0524 0.0139 0.0663 0.0236 3.6731	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0000 0.0042	Toluene 0.0000 0.0000 0.0000 0.0000	Xylene 0.0000 0.0000 0.0000 0.0013	Ethylbenzene	Hexane 0.0000	CO ₂	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355	N ₂ (0
Iotes: Construction emissions are based on rell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Veli Construction Vehicle Road Dust Vehicle Exhaust Subtotal Veli Construction Vehicle Exhaust Drilling Fagines - Tier 2 Drilling Engines - Tier 42 (2011)	CO 	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0000 0.0001	Toluene 0.0000 0.0000 0.0000 0.0018	Xylene	Ethylbenzene	Hexane 0.0000	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355	N ₂ C
iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vell Construction Vehicle Road Dust Vehicle Exhaust Vehicle Fixed Dust Vehicle Fixed Dust Vehicle Fixed Dust Vehicle Fixed Dust Vehicle Fixed Fix	CO 	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311	VOCs	Formaldehyde	### (tons/well) Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042 0.0042	Toluene 0.0000 0.0000 0.0000 0.0018 0.0018	Xylene 0.0000 0.0000 0.0000 0.0013 0.0013	Ethylbenzene	Hexane 0.0000	CO ₂ 11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355	N ₂ (0
Iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Road Dust Subtotal Vell Construction Vehicle Exhaust Drilling Engines - Tier 4a (2011) Drilling Engines - Tier 4b (2015) Subtotal (with Tier 2 critiling)	CO 	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0000 0.0001	Toluene 0.0000 0.0000 0.0000 0.0018	Xylene	Ethylbenzene	Hexane 0.0000	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355	N ₂ (0
Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exh		NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 5.3756		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.2146	PM _{2.5} 0.0276 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.2122	VOCs	Formaldehyde		Toluene	Xylene 0.0000 0.0000 0.0000 0.0001 0.0013 0.0013 0.0013	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0000	CO ₂ 1.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 738.7634	CH ₄ 0.0006 0.0001 0.0001 0.0002 0.0355 0.0355 0.0357	N ₂ c
Iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Road Dust Subtotal Vell Construction Vehicle Exhaust Drilling Engines - Tier 4a (2011) Drilling Engines - Tier 4b (2015) Subtotal (with Tier 2 critiling)	CO 	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311	VOCs	Formaldehyde	### (tons/well) Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042 0.0042	Toluene 0.0000 0.0000 0.0000 0.0018 0.0018	Xylene 0.0000 0.0000 0.0000 0.0013 0.0013	Ethylbenzene	Hexane 0.0000	CO ₂ 11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355	N ₂ c
Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exh		NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 5.3756		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.2146	PM _{2.5} 0.0276 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.2122	VOCs	Formaldehyde		Toluene	Xylene 0.0000 0.0000 0.0000 0.0001 0.0013 0.0013 0.0013	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0000	CO ₂ 1.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 738.7634	CH ₄ 0.0006 0.0001 0.0001 0.0002 0.0355 0.0355 0.0357	N ₂ c
Iotes: Construction emissions are based on elli pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vell Construction Vehicle Road Dust Vehicle Exhaust Drilling Engines - Tier 42 Drilling Engines - Tier 40 (2015) Subtotal (with Tier 2 critting) Completion and Testing Flaring		NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 5.3756 0.0200		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.2146	PM _{2.5} 0.0276 0.2247 0.0006 0.0006 0.0006 0.0000 0.2119 0.1060 0.0311 0.2122	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042 0.0042 0.0042	Toluene 0.0000 0.0000 0.0000 0.00018 0.0018 0.0018	Xylene	Ethylbenzene	Hexane 0.0000 0.0000	11.7530 1.3527 13.1057 1.3627 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0357	N ₂ c
Lotes: Construction emissions are based on reell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Texhaust Vehicle Exhaust Vehicle Texhaust		NO ₅ 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 5.3756 0.0200	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.2146	PM _{2.5} 0.0276 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.2122	vocs 0.0142 0.0038 0.0181 1.4127 0.4238 0.1978 1.4179	Formaldehyde	(tons/well)	Toluene 0.0000 0.0000 0.0000 0.0001 0.0018 0.0018	Xylene	Ethylbenzene 0.0000 0.0000		11.7530 1.3527 13.1057 1.3627 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0357	N ₂ C
Iotes: Construction emissions are based on reili pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust		NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 0.0200		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.03717 0.2146	PM _{2.5} 0.0276 0.2276 0.2276 0.0006 0.2529 0.0003 0.0000 0.2112 0.1060 0.0311 0.2122 0.0015	VOCs	Formaldehyde			Xylene 0.0000 0.0000 0.0000 0.0000 0.0013 0.0013 0.0013	Ethylbenzene 0.0000 0.0000		CO2 11.7530 1.3527 13.1057	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0357	N ₂ C
lotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust Uell Construction Vehicle Exhaust Drilling Engines - Tier 4a (2011) Drilling Engines - Tier 4b (2015) Subtotal (with Tier 2 crilling) Completion and Testing Flaing Waste Pond Evaporation Vehicle Road Dust		NO _x	SO ₂	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0007 0.0000 0.2119 0.7060 0.0311 0.015 7.0221 0.1220	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1080 0.0311 0.2122 0.0015 0.7022 0.1220	VOCs	Formaldehyde			Xylene 0.0000 0.0000 0.0000 0.0000 0.0013 0.0013 0.0000	Ethylbenzene		11.7530 1.3527 13.1057 1.3627 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200 3.3685 63.7560	CH ₄ 0.0006 0.0001 0.0002 0.0355 0.0355 0.0357	N ₂ c
Iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Pump Engines Subtotal		NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0301 0.0000 0.1137	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.2146 0.0015 7.0221 0.12217 7.0221	PM _{2.5} 0.02747 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.2122 0.0015 0.7022 0.1220 0.8257	VOCs	Formaldehyde	- (tons/well) Benzene		Xylene	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0000 0.0009 0.0009	CO ₂	CH ₄ 0.0006 0.0001 0.0006 0.00355 0.0355 0.0357 0.0005 0.0002 0.0142	N ₂ (c 0.00 0.00 0.00 0.00 0.02 0.02 0.02 0.0
otes: Construction emissions are based on ell pad construction. Source Type Fell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Tengines - Tier 4a (2011) Subtotal (with Tier 2 drilling) ompletion and Testing Flaning Waste Pond Exporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL'		NO _x	SO ₂	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0007 0.0000 0.2119 0.7060 0.0311 0.015 7.0221 0.1220	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1080 0.0311 0.2122 0.0015 0.7022 0.1220		Formaldehyde		Toluene 0.0000 0.0000 0.0000 0.0001 0.0018 0.0018 0.0018 0.0000 0.0000 0.0000	Xylene 0.0000 0.0000 0.0000 0.0013 0.0013 0.0013 0.0000 0.0001	Ethylbenzene		11.7530 1.3527 13.1057 1.3627 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200 3.3685 63.7560	CH ₄ 0.0006 0.0001 0.0002 0.0355 0.0355 0.0357	N ₂ (c 0.00 0.00 0.00 0.00 0.02 0.02 0.02 0.0
otes: Construction emissions are based on eell pad construction. Source Type /ell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Velil Production		NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0001 0.0000 0.1138 0.1701	PM ₁₀ 0.1841 2.2488 0.0169 2.4478 0.0007 0.0007 0.1060 0.0311 0.2146 0.0015 7.021 0.1220 7.1456 9.8080	PM _{2.5} 0.0276 0.0276 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1080 0.0311 0.2122 0.0015 0.1220 0.8257 1.2908	VOCs	Formaldehyde	- (tons/well) Benzene		Xylene	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0000 0.0009 0.0009	CO ₂	CH ₄ 0.0006 0.0001 0.0006 0.0355 0.0355 0.0357 0.0005 0.0000 0.0000	N ₂ (0.000 0
Iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Vehicle Fad Ust Vehicle Fad Ust Vehicle Fad Ust Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Velil Production Velater Production V		NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0301 0.0000 0.1137	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.2146 7.0221 0.1220 7.1456	PM _{2.5} 0.02747 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.2122 0.0015 0.7022 0.1220 0.8257	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4127 0.4238 0.1978 1.4179 0.0011 0.3500 0.0095 0.1394 0.5000 1.9359 0.0118	Formaldehyde	Benzene		Xylene	Ethylbenzene 0.0000 0.0000	Hexane	CO ₂	CH4	N ₂ (0.000 0
Iotes: Construction emissions are based on reill pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal (with Tier 2 drilling) Completion and Testing Flaring Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL' Velil Production Heater/Treater Condensate Tanks		NO _x	SO ₂ 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0394 0.0395 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2488 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.0161 7.0221 7.1456 9.8080	PM _{2.5} 0.0276 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1080 0.0311 0.2122 0.0015 0.1220 0.8257 1.2908	VOCs	Formaldehyde 0.0001 0.0001 0.0001 0.0003 0.0053 0.0053 0.0054 0.0000 0.00005 0.00005 0.00005			Xylene	Ethylbenzene	Hexane 0.0000 0.0000 0.0009 0.0009	CO ₂	CH4 0.0006 0.0001 0.0006 0.0355 0.0355 0.0355 0.0357 0.0005 0.00000 0.00000 0.00000	N ₂ C
iotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal (with Tier 2 drilling) Flaring Waste Pond Exporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Velil Production Heater/Treater Condensate Tanks Gas Generator		NO _x		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0000 0.2119 0.1060 0.0311 0.015 0.1220 7.1456 9.8080 0.0163	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0000 0.0000 0.1060 0.0311 0.7022 0.1220 0.8257 1.2908 0.0163 0.0000	VOCs VOCs 0.0142 0.0038 0.0181	Formaldehyde	Benzene	Toluene	Xylene	Ethylbenzene 0.0000 0.0000	Hexane	CO2 11.7530 1.3527 13.1057 13.1057 1.84 1.84 1.84 1.84 1.8520 1.86 1.86 1.86 1.86 1.86 1.86 1.86 1.86	CH4	N ₂ C
Iotes: Construction emissions are based on reil pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal (with Tier 2 drilling) Completion and Testing Flating Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL' Vell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust		NO _x	SO ₂ 0.0169 0.0000 0.0394 0.0394 0.0394 0.0395 0.0301 0.0001 0.0000 0.1137 0.1138 0.1701	PM ₁₀ 0.1841 2.2488 0.0169 2.4478 0.00027 0.0000 0.2119 0.1060 0.0311 0.2146 0.0015 7.0221 0.1220 7.1456 9.8080 0.0163	PM _{2.5} 0.0276 0.0274 0.0006 0.2529 0.0003 0.0000 0.2119 0.1020 0.0311 0.0122 0.015 0.7022 0.1220 0.8257 1.2908	VOCs	Formaldehyde			Xylene	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0000 0.0009 0.0009 0.2498 0.0002	CO ₂	CH4 0.0006 0.0001 0.0006 0.0355 0.0355 0.0355 0.0357 0.0005 0.00000 0.00000 0.00000	N ₂ C
Iotes: Construction emissions are based on ell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal (with Tier 2 drilling) Flaring Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Frace Pump Engines Subtotal CONSTRUCTION TOTAL: Veil Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust		NO _x		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0000 0.2119 0.1060 0.0311 0.015 0.1220 7.1456 9.8080 0.0163	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0000 0.0000 0.1060 0.0311 0.7022 0.1220 0.8257 1.2908 0.0163 0.0000	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4127 0.4238 0.1978 1.4179 0.0011 0.3500 0.0095 0.1394 0.5000 1.9359 0.0118	Formaldehyde	Cons/well Cons	Toluene	Xylene	Ethylbenzene	Hexane	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 736.9200 738.7634 24.0000 	CH4	N ₂ (0.000 0
Iotes: Construction emissions are based on reil pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Torrilling Engines - Tire + da (2011) Subtotal (with Tier 2 drilling) Completion and Testing Flating Vehicle Exhaust Frac Pump Engines CONSTRUCTION TOTAL' Vell Production Heater/Treater Vehicle Exhaust Gas Generator Vehicle Road Dust		NO _x		PM ₁₀ 0.1841 2.2488 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.0161 7.0221 7.1458 9.8080 0.0163 0.0000 0.8247 5.4255	PM _{2.5} 0.0276 0.0274 0.0006 0.2529 0.0003 0.0000 0.2119 0.1020 0.0015 0.7022 0.8257 1.2908 0.0163 0.0000 0.4948 0.5425	VOCs	Formaldehyde			Xylene	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0009 0.0009 0.2498 0.0002	CO ₂ 11.7530 1.3527 13.1057	CH4	N ₂ (0
Iotes: Construction emissions are based on ell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal (with Tier 2 drilling) Flaring Venicle Fond Evaporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL: Veil Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal Vehicle Exhaust Subtotal		NO _x		PM ₁₆ 0.1841 2.2468 0.0169 0.0000 0.2119 0.0000 0.2119 0.0015 0.1220 7.1456 9.8080 0.0163 0.0000 0.8247 5.4255 6.2665	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.0015 0.7022 0.1220 0.0163 0.0000 0.4149 0.0000 0.4141 0.0000 0.4141 0.10537	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4127 0.4238 0.1979 0.0011 0.3500 0.0095 0.1394 0.5000 1.9359 0.0118 15.9300 0.0111 15.9310	Formaldehyde	Cons/well	Toluene	Xylene	Ethylbenzene	Hexane	CO2 11.7530 1.3527 13.1057 13.1057 1.8434 736.9200 736.9200 738.7634 24.0000 3.3695 63.7560 27.3695 27.3695 27.3695 27.3695 27.3695 303.0161	CH4	N ₂ 0
Iotes: Construction emissions are based on reili pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Tilling Engines - Tiler 4a (2011) Drilling Engines - Tiler 4a (2011) Subtotal (with Tiler 2 drilling) Flaring Vehicle Exhaust Frac Pump Engines Subtotal Construction Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Subtotal PRODUCTION TOTAL.		NO _x		PM ₁₀ 0.1841 2.2488 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.0161 7.0221 7.1458 9.8080 0.0163 0.0000 0.8247 5.4255	PM _{2.5} 0.0276 0.0274 0.0006 0.2529 0.0003 0.0000 0.2119 0.1020 0.0015 0.7022 0.8257 1.2908 0.0163 0.0000 0.4948 0.5425	VOCs	Formaldehyde			Xylene	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0009 0.0009 0.2498 0.0002	CO ₂ 11.7530 1.3527 13.1057	CH4	N ₂ (2
otes: Construction emissions are based on ell pad construction. Source Type Fell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Torilling Engines - Tier 4a (2011) Subtotal (with Tier 2 drilling) Ompletion and Testing Flaring Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Frace Pump Engines Subtotal CONSTRUCTION TOTAL Fell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Subtotal PRODUCTION TOTAL Vehicle Exhaust Subtotal PRODUCTION TOTAL CONSTRUCTION AND		NO _x		PM ₁₆ 0.1841 2.2468 0.0169 0.0000 0.2119 0.0000 0.2119 0.2146 0.0015 0.1220 7.1456 9.8080 0.0163 0.0000 0.8247 5.4255 6.2665	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0000 0.0000 0.0110 0.00311 0.0015 0.7022 0.1220 0.0163 0.0000 0.4148 0.0000 0.4948 0.5425 1.0537	VOCs	Formaldehyde	Cons/well Cons	Toluene	Xylene	Ethylbenzene	Hexane	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 738.7634 24.0000 	CH4	N ₂ C 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.
otes: Construction emissions are based on eell pad construction. Source Type /ell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Orilling Engines - Tier 4a (2011) Fulling Engines - Tier 4a (2011) Subtotal (with Tier 2 drilling) Ompletion and Testing Flaring Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL' /ell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Exhaust Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Subtotal PRODUCTION TOTAL.		NO _x		PM ₁₆ 0.1841 2.2468 0.0169 0.0000 0.2119 0.0000 0.2119 0.0015 0.1220 7.1456 9.8080 0.0163 0.0000 0.8247 5.4255 6.2665	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.0015 0.7022 0.1220 0.0163 0.0000 0.4149 0.0000 0.4141 0.0000 0.4141 0.10537	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4127 0.4238 0.1979 0.0011 0.3500 0.0095 0.1394 0.5000 1.9359 0.0118 15.9300 0.0111 15.9510	Formaldehyde	Cons/well	Toluene	Xylene	Ethylbenzene	Hexane	CO2 11.7530 1.3527 13.1057 13.1057 1.8434 736.9200 736.9200 738.7634 24.0000 3.3695 63.7560 27.3695 27.3695 27.3695 27.3695 27.3695 303.0161	CH4	N ₂ 00
otes: Construction emissions are based on ell pad construction. Source Type Fell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Torilling Engines - Tier 4a (2011) Subtotal (with Tier 2 drilling) Ompletion and Testing Flaring Vehicle Road Dust Vehicle Road Dust Vehicle Exhaust Frace Pump Engines Subtotal CONSTRUCTION TOTAL Fell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Subtotal PRODUCTION TOTAL Vehicle Exhaust Subtotal PRODUCTION TOTAL CONSTRUCTION AND		NO _x		PM ₁₆ 0.1841 2.2468 0.0169 0.0000 0.2119 0.0000 0.2119 0.2146 0.0015 0.1220 7.1456 9.8080 0.0163 0.0000 0.8247 5.4255 6.2665	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0000 0.0000 0.0110 0.00311 0.0015 0.0015 0.1020 0.1220 0.0163 0.0000 0.4948 0.5425 1.0537	VOCs	Formaldehyde	Cons/well Cons	Toluene	Xylene	Ethylbenzene	Hexane	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200 738.7634 24.0000 	CH4	N ₂ (0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0

Verlicke Franzer Verlicke Fra							NS SUMMA									
Self Paul Controllection Wholes Road Dots						Е	missions by	Source Categor	y (lbs/well)							
Selection Sele	Source Type	CO	NO _v	SO ₂	PM ₁₀	PM2 6	VOCs	Formaldehyde	Benzene	Toluene	Xvlene	Ethylbenzene	Hexane	CO ₂	CH ₄	N ₂ O
Verbeich Rohard Lord Verbeich					1 11110	1 1112.5					,					
Verbier Roberholes					368.22	55.23										
Verbeite Prinance 1,000					4,493.57	449.36										
Part Control Bulber 19,241 392.55 33.77 4.89.55 69.78 84.13 6.19 6.15 6.06 6.05 6.00 6	Equipment Exhaust	104.85	342.65	33.76	33.76	1.19	28.49	0.17	0.13	0.06	0.04			23,506	1.13	0.70
February	Vehicle Exhaust	27.76	10.30	0.01			7.64	0.02	0.02	0.0065	0.0045			2,705	0.12	0.08
Velocie Robot Desi		132.61	352.95	33.77	4,895.55	505.78	36.13	0.19	0.15	0.06	0.05	0.00	0.00	26,211.35	1.26	0.77
Verbies Defaules 67.22																
Deling Engines - Time 2 Deling Engines - Time 4 defilling 1																
Daling Engines - Tier 4s (2011) 7,346.19 7,364.19 7,862 21.91 21.91 21.91 47.54 10.90 8.37 3.67 2.56 - 1.147.040 77.00 43.7 20.00												-	-			
Deling Exprogres - The 48 (2019) 7-2012 7-20																
Substack (with Turk 4s defining) 7-39.4.1 7,966.00 78.9.2 217.37 212.51 87.79 10.72 8.46 3.49 2.57 0.00 0.00 1.00 1.477.56(72.77.4.3 4.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00									8.37		2.56	-				
semplestion and Tealing Wasse Pool Exposition			7,070.70	70.02					8.37		2.56	0.00	0.00			
Fibring Planet Frederick 33.00 40.00 0 3.04 3.04 2.00	Subtotal (with Her 4a drilling)	7,393.41	7,360.60	78.82	217.37	212.51	857.90	10.73	8.46	3.69	2.57	0.00	0.00	1,477,526.72	71.43	44.0
Wass Perofice Regoration		33.60	40.00	0	3.04	3.04	2 20		0.00	0.00			1 91	48 000	0.02	0.89
Verbicke Fishans					3.04	3.04										
Verleice Enhanced Fig. 20 Verleice Enhanced					14.044.29	1.404.43										
Fige Purp Engines		71.20	25.72	0.04			19.00	0.07	0.06	0.02	0.01	-		6.737	0.34	0.24
Substate Sels-de 360-309 277.58 14,291.77 19,116.15 3,296.90 1,999.90 0,07 0,06 0,02 0,01 0,00 1,81 15,954.74.90 1,26 1,15					243.94	243.94										
CONSTRUCTION TOTAL.								0.07	0.06	0.02		0.00	1.81			1.12
Vertical Production 160 17 429.41 2.5765 32.6353 22.6353 22.6376 0.32 0.01 0.01																
Condensate Tanks					T.,	1										
Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions are based on a per well constructed/delied basis. Construction emissions experience by constructed and associated wells are drilled. All drilling is assumed to be completed in the year real part of the year real part o	Heater/Treater	360.71	429.41	2.5765	32.6353	32.6353	23.6176	0.32	0.01	0.01				515,294	9.88	9.4
Gas Generator Wind Blown Dust													499.50	-		
Wind Blown Dust		236.87	3,048.69	0.44				41.25	0.33	0.30	0.14	0.03		82,195		
Vehicle Exhaust 70.86 28.00 0.03 20.14 0.22 0.17 0.05 0.03 6.543 0.90 0.65 0.05 0.05 0.03 0.03 498.53 506.032.24 10.78 10.15 0.05																
Surce Type Co No So PM PM PM PM Source Category (trons/well) Source Type Co No So PM PM PM PM PM PM PM P					10,850.98	1,085.10										
PRODUCTION TOTAL CONSTRUCTION AND PRODUCTION TOTAL 9,039,02 14,722,85 343,22 31,937,17 4,477,07 33,797,75 52.78 100,98 4.15 2,81 0.03 501,64 2,164,597,24 84,77 95 56.0 total production emissions are based on a per well constructed/defilled basis. Construction emissions are based on a per well constructed defilled basis. Construction emissions are based on a per well constructed basis. Construction emissions are based on a per well constructed defilled basis. Construction emissions by Source Category (tons/well). Emissions by Source Category (tons/well)																
CONSTRUCTION AND PRODUCTION TOTAL PRODUCTION TOTAL 9,939.92 14,722.65 343.22 31,937.17 4,477.07 33,797.75 52.78 100.98 4.15 2.81 0.03 501.64 2,164,507.24 84.73 58.0 58.0 58.0 59.0 59.0 59.0 59.0 59.0 59.0 59.0 59																
PRODUCTION TOTAL 0,039.92 14,722.65 343.22 31,937.17 4,477.07 33,797.75 52.78 100.98 4.15 2.81 0.03 501.64 2,164,507.24 84.73 56.0	PRODUCTION TOTAL	668.43	3,506.10	3.05	12,532.99	2,107.38	31,903.76	41.78	92.31	0.37	0.17	0.03	499.83	606,032.24	10.78	10.1
Construction emissions are based on a per well constructed/drilled basis. Construction emissions occur only in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed. Filter Principle Pri	CONSTRUCTION AND															
Construction emissions are based on a per well constructed/drilled basis. Construction emissions occur only in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed and associated wells are drilled. All drilling is assumed to be completed in the year that a well pad is constructed. Filter Principle Pri		9.039.92	14.722.65	343.22	31.937.17	4.477.07	33.797.75	52.78	100.98	4.15	2.81	0.03	501.64	2.164.507.24	84.73	56.0
Feb Pad Construction	otes: Construction emissions are based on		onstructed/dr	illed basis.	Construction					structed and	associated w	rells are drilled. A	All drilling is a	assumed to be co	ompleted in t	he year
General Activity	otes: Construction emissions are based on		constructed/dri	illed basis.	Construction					structed and	associated w	rells are drilled. A	All drilling is a	assumed to be co	ompleted in t	he year
Vehicle Road Dust	iotes: Construction emissions are based on ell pad construction.	a per well o				Er	nissions by S	Source Category	(tons/well)							
Equipment Exhaust 0.0524 0.1713 0.0169 0.0069 0.0060 0.0001 0.0000 0.000	lotes: Construction emissions are based on rell pad construction.	a per well o			PM ₁₀	Er PM _{2.5}	nissions by S	Source Category	(tons/well)							
Vehicle Exhaust 0.0139 0.0051 0.0000 0	lotes: Construction emissions are based on ell pad construction. Source Type Veil Pad Construction General Activity	a per well o	NO _x	SO ₂	PM ₁₀	PM _{2.5}	nissions by S	Source Category	(tons/well) Benzene	Toluene	Xylene	Ethylbenzene	Hexane	CO ₂	CH ₄	N₂O
Subtoal 0.0663 0.1765 0.0169 2.478 0.2529 0.181 0.0001 0.0001 0.0000 0.	lotes: Construction emissions are based on rell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust	CO	NO _x	SO ₂	PM ₁₀ 0.1841 2.2468	PM _{2.5} 0.0276 0.2247	VOCs	Source Category Formaldehyde	(tons/well) Benzene	Toluene	Xylene	Ethylbenzene	Hexane	CO ₂	CH₄ 	N₂O
Velicle Exhaust	lotes: Construction emissions are based on reell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust	CO	NO _x	SO₂ 0.0169	PM ₁₀ 0.1841 2.2468	PM _{2.5} 0.0276 0.2247	VOCs 0.0142	Formaldehyde 0.0001	Benzene 0.0001	 0.0000	 0.0000	Ethylbenzene 	Hexane	CO ₂	CH ₄	N ₂ O
Vehicle Road Dust	lotes: Construction emissions are based on well pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust	CO	NO _x 0.1713 0.0051	SO ₂ 0.0169 0.0000	PM ₁₀ 0.1841 2.2468 0.0169	PM _{2.5} 0.0276 0.2247 0.0006	VOCs	Formaldehyde 0.0001 0.0000	(tons/well) Benzene 	Toluene 0.0000 0.0000	Xylene 0.0000 0.0000	Ethylbenzene	Hexane	CO ₂ 11.7530 1.3527	CH ₄ 0.0006 0.0001	N ₂ O
Vehicle Exhaust	lotes: Construction emissions are based on elil pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal	CO	NO _x 0.1713 0.0051	SO ₂ 0.0169 0.0000	PM ₁₀ 0.1841 2.2468 0.0169	PM _{2.5} 0.0276 0.2247 0.0006	VOCs	Formaldehyde 0.0001 0.0000	(tons/well) Benzene 	Toluene 0.0000 0.0000	Xylene 0.0000 0.0000	Ethylbenzene	Hexane	CO ₂ 11.7530 1.3527	CH ₄ 0.0006 0.0001	N ₂ O
Drilling Engines - Tier 2 Drilling Engines - Tier 2 Drilling Engines - Tier 2 Drilling Engines - Tier 4 (2011) Drilling Engines - Tier 4 (2011) Drilling Engines - Tier 4 (2011) Drilling Engines - Tier 4 (2015) Drilling Engines - Tier 4 (2016) Drilling Engines - Ti	lotes: Construction emissions are based on early pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Veil Construction	CO	NO _x 0.1713 0.0051	SO ₂ 0.0169 0.0000	PM ₁₀ 0.1841 2.2468 0.0169 2.4478	PM _{2.5} 0.0276 0.2247 0.0006 0.2529	VOCs	Formaldehyde 0.0001 0.0000	(tons/well) Benzene 	Toluene 0.0000 0.0000	Xylene 0.0000 0.0000	Ethylbenzene	Hexane	CO ₂ 11.7530 1.3527	CH ₄ 0.0006 0.0001	N ₂ O
Drilling Engines - Tier 4a (2011) 3.6731 3.6731 0.0394 0.1060 0.1060 0.4238 0.0053 0.0042 0.0018 0.0013	lotes: Construction emissions are based on elil pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Velli Construction	CO	NO _x	SO ₂ 0.0169 0.0000 0.0169	PM ₁₀ 0.1841 2.2468 0.0169 2.4478	PM _{2.5} 0.0276 0.2247 0.0006 0.2529	VOCs	Formaldehyde 0.0001 0.0000	Benzene	Toluene	Xylene		Hexane 0.0000	CO ₂ 11.7530 1.3527 13.1057	CH ₄ 0.0006 0.0001 0.0006	N ₂ C
Drilling Engines - Tier 4b (2015) Subtotal (with Tier 4a principle) Subtotal (viet) Frace Pump Engines Subtotal (viet) Subtota	lotes: Construction emissions are based on earlier pad construction. Source Type Veill Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Veli Construction Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust	CO	NO _x 0.1713 0.0051 0.1765	SO ₂ 0.0169 0.0000 0.0169	PM ₁₀ 0.1841 2.2468 0.0169 2.4478	PM _{2.5} 0.0276 0.2247 0.0006 0.2529	VOCs	Formaldehyde	(tons/well)	Toluene 0.0000 0.0000 0.0000	Xylene 0.0000 0.0000 0.0000		Hexane	CO ₂ 11.7530 1.3527 13.1057	CH ₄ 0.0006 0.0001 0.0006	N ₂ O
Subtotal (with Tief 4a drilling) 3.6967 3.6803 0.0394 0.1087 0.1063 0.4289 0.0054 0.0042 0.0018 0.0013 0.0000 0.0000 0.0000 0.0000 0.0057 0.0257 0.	Lotes: Construction emissions are based on well pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Vehicle Road Dust Vehicle Exhaust	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0000 0.0001	Toluene 0.0000 0.0000 0.0000 0.0000	Xylene 0.0000 0.0000 0.0000 0.0013	Ethylbenzene	Hexane 0.0000	CO ₂	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355	N ₂ O
Completion and Testing Completion Completion and Testing Completion Completi	lotes: Construction emissions are based on elli pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vell Construction Vehicle Road Dust Vehicle Exhaust Juilling Engines - Tier 2 Drilling Engines - Tier 42 (2011)	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060	vocs	Formaldehyde	(tons/well) Benzene 	Toluene 0.0000 0.0000 0.0000 0.0018 0.0018	Xylene 0.0000 0.0000 0.0000 0.0000 0.0013	Ethylbenzene	Hexane 0.0000	CO ₂	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355	N ₂ C
Flaring 0.0168 0.0200 0.0001 0.0015 0.0011 0.0000 0.0000 0.0009 24.0000 0.0005 0.0001	Lotes: Construction emissions are based on well pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Tend Dust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Fire 4 Dust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Fire 4 Dust Vehicle Exhaust	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0027 0.1060 0.2119 0.1060	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042	Toluene 0.0000 0.0000 0.0000 0.0000 0.0018 0.0018	Xylene 0.0000 0.0000 0.0000 0.0000 0.0013 0.0013		Hexane 0.0000	CO ₂ 11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355	N ₂ C 0.000 0.000 0.000 0.000 0.02:
Waste Pond Exporation	lotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vell Construction Vehicle Exhaust Subtotal Vell Construction Vehicle Exhaust 5 Vell Construction Vehicle Exhaust 6 Vell Construction Vehicle Exhaust 7 Velli Construction 7 Vehicle Exhaust 7 Velli Construction 8 Velli Construction 9 Velli Constructi	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0027 0.1060 0.2119 0.1060	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042	Toluene 0.0000 0.0000 0.0000 0.0000 0.0018 0.0018	Xylene 0.0000 0.0000 0.0000 0.0000 0.0013 0.0013		Hexane 0.0000	CO ₂ 11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 736.9200	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355	N ₂ C 0.000 0.000 0.000 0.000 0.02:
Vehicle Road Dust	lotes: Construction emissions are based on reill pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Fixed Times - Time 4a (2011) Drilling Engines - Time 4a (2015) Subtotal (with Time 4 ad rilling) Subtotal (with Time 4 ad rilling)	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6803	SO ₂ 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.1087	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.1063	VOCs	Formaldehyde	(tons/well) Benzene 	Toluene	Xylene	Ethylbenzene	Hexane 0.0000 0.0000	CO ₂ 1.7530 1.3527 13.10571.8434 736.9200 736.9200 738.7634	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0355	N ₂ C 0.000 0.000 0.000 0.000 0.02 0.02 0.02 0.02
Vehicle Exhaust 0.0356 0.0129 0.0000 0.0005 0.0000 0.0000 0.0000 3.3885 0.0002 0.0002 0.0001 63.7560 0.0142 63.7560 0.01	lotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Subtotal Vell Construction Vehicle Road Dust Vehicle Road Dust Drilling Engines - Tier 2 Drilling Engines - Tier 4a (2011) Drilling Engines - Tier 4a drilling) Subtotal (with Tier 4a drilling) Completion and Testing Flaring	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 3.6803	SO ₂ 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.1087	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.1063	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042 0.0042	Toluene	Xylene 0.0000 0.0000 0.0000 0.0000 0.00013 0.0013	Ethylbenzene	Hexane 0.0000 0.0000	CO ₂ 1.7530 1.3527 13.10571.8434 736.9200 736.9200 738.7634	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0355	N ₂ C 0.000 0.000 0.000 0.000 0.02 0.02 0.02 0.02
Frace Pump Engines Subtotal 0,3703 1,7186 0,1137 0,1220 0,1220 0,1394 0,0005 0,0004 0,0002 0,0001 0,0000 0,	otes: Construction emissions are based on elil pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Drilling Fagines - Tier 4a (2011) Drilling Fagines - Tier 4a (2011) Subtotal (with Tier 4a drilling) Ompletion and Testing Flaring Flaring Vaste Pond Evaporation	CO	NO _x 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6731 3.6803	SO ₂ 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1087	PM _{2.5} 0.0276 0.2247 0.0006 0.0006 0.0006 0.0000 0.2519 0.1060 0.0311 0.1063	VOCs	Formaldehyde	Benzene 0.0001 0.0000 0.0001 0.0000 0.0042 0.0042 0.0042	Toluene	Xylene 0.0000 0.0000 0.0000 0.0000 0.00013 0.0013	Ethylbenzene		CO ₂ 1.7530 1.3527 13.10571.8434 736.9200 736.9200 738.7634	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0355	N ₂ C 0.000 0.000 0.000 0.000 0.02 0.02 0.02 0.02
Subtotal 0.4227 1.7515 0.1138 7.1456 0.8257 0.5000 0.0000	lotes: Construction emissions are based on rell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Vehicle Exhaust Jording Engines - Tier 2 Drilling Engines - Tier 4a (2011) Drilling Engines - Tier 4a drilling) Subtotal (with Tier 4a drilling) Completion and Testing Flaring Waste Pond Exeporation Vehicle Road Dust	CO	NO ₅ 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6803	SO ₂ 0.0169 0.0000 0.0169 0.0394 0.0394 0.0394 0.0394	PM ₁₀ 0.1841 2.2488 0.0169 2.4478 0.0027 0.0000 0.2119 0.1080 0.0311 0.1087	PM _{2.5} 0.0.276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2719 0.1060 0.0031 0.1063	vocs 0.0142 0.0142 0.0181 0.0051 1.4127 0.4238 0.1978 0.4289	Formaldehyde	(tons/well) Benzene 0.0001 0.0000 0.0000 0.0000 0.0042 0.0042 0.0042 0.0042	Toluene	Xylene	Ethylbenzene 0.0000 0.00000	Hexane	CO ₂	CH ₄ 0.0006 0.0001 0.0002 0.0355 0.0355 0.0355 0.0357	N ₂ C 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
Vell Production Vell Produ	lotes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Jorilling Engines - Tier 4a (2011) Drilling Engines - Tier 4a drilling) Completion and Testing Flaring Waste Pond Exporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines	a per well c	NO _x 0.1713 0.0051 0.1765 0.0072 6.36844 3.6731 3.6803		PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0000 0.2719 0.1060 0.0311 0.1067 0.1067 0.0015	PM _{2.6} 0.0274 0.0224 0.02247 0.0006 0.2529 0.0003 0.0009 0.1060 0.0311 0.1063 0.0015 0.7022 0.1220	VOCs	Formaldehyde			Xylene 0.0000 0.0000 0.0000 0.0001 0.00013 0.0000	Ethylbenzene 0.0000 0.00000		CO ₂	CH4 0.0006 0.0001 0.0001 0.0002 0.3355 0.0355 0.0355 0.0002	N ₂ C 0.000 0.000 0.000 0.000 0.002 0.002 0.002 0.002 0.002
Vell Production Vell Produ	lotes: Construction emissions are based on reliel pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Pump Engines Subtotal	CO	NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0394 0.0001 0.0000 0.1137	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.1087 7.0221 0.1220 7.1456	PM _{2.6} 0.0274 0.0224 0.02247 0.0006 0.2529 0.0003 0.0009 0.1060 0.0311 0.1063 0.0015 0.7022 0.1220	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4127 0.4238 0.1978 0.4239 0.0011 0.3500 0.00015 0.00055 0.00055 0.00055 0.00055 0.01394	Formaldehyde	(tons/well) Benzene 0.0001 0.0000 0.0001 0.0002 0.0042 0.0042 0.0042 0.0042 0.0000 0.0000 0.0000	Toluene	Xylene 0.0000 0.0000 0.0000 0.0001 0.0013 0.0013 0.0000 0.0000 0.0000	Ethylbenzene 0.0000 0.00000		CO ₂ 11.7530 1.3527 13.1057 - 1.8434 736.9200 736.7634 24.0000 - 3.3685 63.7560 27.3685	CH ₄ 0.0006 0.0001 0.0001 0.0002 0.0355 0.0355 0.0355 0.0005 0.0005	N ₂ C 0.000 0.000 0.000 0.000 0.002 0.002 0.002 0.002 0.000
Condensate Tanks	otes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Trying Engines - Tier 4a (2011) Drilling Engines - Tier 4a (2011) Ompletion and Testing Flaing Waste Pond Exporation Vehicle Road Dust Vehicle Exhaust Frace Pump Engines Subtotal CONSTRUCTION TOTAL ¹	CO	NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0394 0.0001 0.0000 0.1137	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.1087 7.0221 0.1220 7.1456	PM _{2.5} 0.02747 0.0006 0.2529 0.0000 0.0003 0.0000 0.1060 0.1060 0.0165 0.7022 0.1225 0.8257	VOCs	Formaldehyde 0.0001 0.0000 0.0001 0.0053 0.0053 0.0054 0.0000 0.0000			Xylene	Ethylbenzene 0.0000 0.0000 0.0000		CO ₂ 11.7530 1.3527 13.1057 - 1.8434 736.9200 736.7634 24.0000 - 3.3685 63.7560 27.3685	CH ₄ 0.0006 0.0001 0.0006 0.0355 0.0355 0.0357 0.0005 0.00002 0.0142	N ₂ C 0.000 0.000 0.000 0.000 0.002 0.022 0.022 0.002 0.000 0.000
Gas Generator 0.1184 1.5243 0.0002 0.0000 0.0000 0.0000 - 0.0206 0.0002 0.0001 0.0000 0.0000 0.0002 41.0975	otes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Vel IP Foduction	CO	NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0394 0.0133 0.1133	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0007 0.0000 0.2119 0.1060 0.0311 0.1087 0.0001 7.021	PM _{2.5} 0.0274 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.1063 0.0015 0.702 0.702 0.8257	VOCs	Formaldehyde 0.0001 0.0000 0.0001 0.0001 0.0053 0.0053 0.0054 0.0000 0.0005			Xylene	Ethylbenzene 0.0000 0.0000 0.0000		CO ₂ 11.7530 1.3527 13.1057 1.3627 13.4057 1.8434 736.9200 738.7634 24.0000 2.3685 63.7560 63.7560 779.2375	CH ₄ 0.0006 0.0001 0.0006 0.0355 0.0355 0.0357 0.0005 0.0000 0.00142 0.0000	N ₂ C 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
Wind Blown Dust 0.8247 0.4948	otes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust First Ag (2011) Subtotal (with Tier 4a drilling) Orphiling Engines - Tier 4b (2015) Subtotal (with Tier 4a drilling) Orphiling Engines - Tier 4b (2015) First Purp Perione Vehicle Road Dust Vehicle Exhaust Frace Purp Engines Subtotal CONSTRUCTION TOTAL. Vell Production Velative Treater	CO	NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0394 0.0133 0.1133	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0007 0.0000 0.2119 0.1060 0.0311 0.1087 0.0001 7.021	PM _{2.5} 0.0274 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.1063 0.0015 0.702 0.702 0.8257	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4123 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010 0.0010	Formaldehyde 0.0001 0.0000 0.0001 0.0001 0.0053 0.0053 0.0054 0.0000 0.0005	Cons/well Benzene		Xylene	Ethylbenzene 0.0000 0.0000		CO ₂ 11.7530 1.3527 13.1057 1.3627 13.4057 1.8434 736.9200 738.7634 24.0000 2.3685 63.7560 63.7560 779.2375	CH ₄ 0.0006 0.0001 0.0006 0.0355 0.0355 0.0357 0.0005 0.0000 0.00142 0.0000	N ₂ C 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
Vehicle Road Dust	otes: Construction emissions are based on elil pad construction. Source Type /ell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL¹ /ell Production Heater/Treater Condensate Tanks	CO	NO _x	SO ₂ 0.0169 0.0000 0.0169 0.0394 0.0394 0.0394 0.0394 0.0001 0.0000 0.1138 0.1701	PM ₁₉ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1080 0.0311 0.00015 7.021 7.1456 9.7021	PM _{2.5} 0.0274 0.02247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0311 0.1063 0.7022 0.1220 0.8257 1.1848	VOCs	Formaldehyde			Xylene	Ethylbenzene 0.0000 0.0000	Hexane 0.0000 0.0009 0.0009 0.0009	CO ₂	CH4 0.0006 0.0001 0.0006 0.0355 0.0355 0.0355 0.0355 0.0357 0.0002 0.0006	N ₂ C 0.000 0.000 0.000 0.000 0.002 0.002 0.002 0.000 0.000 0.000 0.000 0.000
Vehicle Exhaust 0.0354 0.0140 0.0000 0.0101 0.0001 0.0001 0.0000 0.0000 4.2715 0.0004 0.0001 0.0001 0.0000 0.00	otes: Construction emissions are based on ell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust First Ag (2011) Subtotal (with Tier 4a drilling) Completion and Testing Flaring Waste Pond Evaporation Vehicle Exhaust Frace Pump Engines Subtotal CONSTRUCTION TOTAL Velil Production Heater/Treater Condensate Tanks Gas Generator	CO	NO _x	SO ₂	PM ₁₀ 0.1941 2.2468 0.0169 2.4478 0.0000 0.2119 0.1060 0.0015 0.1020 7.1456 9.7021 0.0163 0.0006	PM _{2.5} 0.0276 0.2247 0.0006 0.2529 0.0000 0.0000 0.1060 0.1060 0.0015 0.7022 0.1220 0.8257 1.1848 0.0163	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4/127 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.01394 0.5000 0.9470 0.0118	Formaldehyde	Cons/well	Toluene	Xylene	Ethylbenzene		11.7530 1.3527 13.1057 13.1057 13.1057 13.424 736.9200 736.9200 738.7634 24.0000 3.3685 63.7650 27.3685 27.3685 27.3685 27.3685 27.3685 27.3685 27.3685	CH ₄ 0.0006 0.0001 0.0006 0.0001 0.0002 0.0355 0.0355 0.0355 0.0005 0.0005 0.0006 0.0006 0.0006	N ₂ C 0.000 0.000 0.000 0.000 0.02 0.02 0
Subtotal 0.3342 1.7531 0.0015 6.2665 1.0537 15.9519 0.0209 0.0462 0.0002 0.0001 0.0000 0.2499 303.0161 0.0054 0.005 PRODUCTION TOTAL 0.3342 1.7531 0.0015 6.2665 1.0537 15.9519 0.0209 0.0462 0.0002 0.0001 0.0000 0.2499 303.0161 0.0054 0.005 CONSTRUCTION AND PRODUCTION TOTAL 4.5200 7.3613 0.1716 15.9686 2.2385 16.8989 0.0264 0.0505 0.0021 0.0014 0.0000 0.2508 1082.2536 0.0424 0.021 Otels:	otes: Construction emissions are based on elil pad construction. Source Type /ell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Purp Engines Subtotal CONSTRUCTION TOTAL¹ /ell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust	CO	NO _x	SO ₂	PM ₁₉ 0.1841 2.2488 0.0169 2.4478 0.0027 0.0000 0.2119 0.1080 0.0311 0.0015 7.0221 0.1220 0.1456 9.7021	PM _{2.5} 0.0276 0.02247 0.0006 0.2529 0.0003 0.0000 0.1060 0.0311 0.1063 0.0015 1.1848 0.0163 0.0163	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4/127 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.01394 0.5000 0.9470 0.0118	Formaldehyde	Cons/well	Toluene	Xylene	Ethylbenzene 0.0000 0.0000		11.7530 1.3527 13.1057 13.1057 13.1057 13.424 736.9200 736.9200 738.7634 24.0000 3.3685 63.7650 27.3685 27.3685 27.3685 27.3685 27.3685 27.3685 27.3685	CH ₄ 0.0006 0.0001 0.0006 0.0001 0.0002 0.0355 0.0355 0.0355 0.0005 0.0005 0.0006 0.0006 0.0006	N ₂ C 0.000 0.000 0.000 0.000 0.02 0.02 0
PRODUCTION TOTAL 0.3342 1.7531 0.0015 6.2665 1.0537 15.9519 0.0209 0.0462 0.0002 0.0001 0.0000 0.2499 303.0161 0.0054 0.005	lotes: Construction emissions are based on elil pad construction. Source Type Jell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Frac Pump Engines Subtotal Vehicle Fond Exporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Vehicle Road Dust	CO	NO _x		PM ₁₉ 0.1841 2.2488 0.0169 2.4478 0.0027 0.0000 0.2119 0.1080 0.0311 0.0015 7.0221 0.1220 0.1456 9.7021	PM _{2.5} 0.0276 0.02247 0.0006 0.2529 0.0003 0.0000 0.1060 0.0311 0.1063 0.0015 1.1848 0.0163 0.0163	VOCs VOCs	Formaldehyde	Cons/well Benzene		Xylene	Ethylbenzene 0.0000 0.0000		11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 738.7634 24.0000 	CH4	N ₂ C 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0020 0.0020 0.0000 0.0000 0.0000 0.0000
CONSTRUCTION AND PRODUCTION TOTAL 4.5200 7.3613 0.1716 15.9686 2.2385 16.8989 0.0264 0.0505 0.0021 0.0014 0.0000 0.2508 1082.2536 0.0424 0.021	Jotes: Construction emissions are based on reell pad construction. Source Type Vell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Torilling Engines - Tier 4a (2011) Drilling Engines - Tier 4a (2011) Subtotal (with Tier 4a drilling) Completion and Testing Flaring Waste Pond Exaporation Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Velil Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Road Dust Vehicle Road Dust Vehicle Road Dust	CO	NO ₂ 0.1713 0.0051 0.1765 0.0072 5.3684 3.6731 3.6803 0.0200 1.7515 5.6083 0.2147 1.5243 0.0140	50 ₂ 0.0169 0.0000 0.0169 0.0000 0.0394 0.0394 0.0394 0.0394 0.0001 0.0000 0.1137 0.1701 0.0013 0.00002 0.00002	PM ₁₀ 0.1841 2.2468 0.0169	Err PM2.5 0.0276 0.2247 0.0006 0.0006 0.2529 0.0003 0.0000 0.2119 0.1063 0.0015 0.0015 0.0222 0.0227 1.1848 0.0163 0.0163	VOCs	Source Category Formaldehyde	Benzene			Ethylbenzene		11.7530 1.3527 13.1057 1.3527 13.1057 1.8434 756.9200 738.9200 738.7634 24.0000 3.3685 63.7560 27.3685 779.2375 257.6471 41.0975 4.2715	CH ₄ 0.0006 0.0001 0.0006 0.0002 0.0355 0.0355 0.0357 0.0006 0.0006 0.0007 0.0002 0.0142 0.0006	N ₂ C
PRODUCTION TOTAL 4.5200 7.3613 0.1716 15.9686 2.2385 16.8989 0.0264 0.0505 0.0021 0.0014 0.0000 0.2508 1082.2536 0.0424 0.024	Source Type Source Type Veil Pad Construction General Activity Vehicle Road Dust Vehicle Exhaust Jordina Farjines - Tier 4a (2011) Subtotal (with Tier 4a drilling) Flaining Waste Pond Evaporation Vehicle Road Dust Vehicle Exhaust Frace Pump Engines Subtotal CONSTRUCTION TOTAL Velil Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Exhaust	CO	NO _x	SO ₂	PM ₁₀ 0.1941 2.2468 0.0169 2.4478 0.0002 0.0000 0.2119 0.1060 0.0015 7.0221 0.1220 7.1456 9,7021 0.0163 0.0000 0.8247 5.4255 6.2665	Err PM2.5 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0165 0.0015 0.7022 1.1848 0.0163 0.0000 0.4948 0.5425 1.0853	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4/127 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.0118 15.9300 0.9470 0.0118 15.9300	Formaldehyde	Cons/well Benzene	Toluene	Xylene	Ethylbenzene	0.0000 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 738.9200 738.7634 24.0000 	CH ₄	N ₂ C
otes:	otes: Construction emissions are based on elil pad construction. Source Type /ell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Torlling Engines - Tier 4a (2011) Subtotal (with Tier 4a drilling) Ompletion and Testing Flaring Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL /ell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Road Dust Vehicle Exhaust Subtotal PRODUCTION TOTAL	CO	NO _x	SO ₂	PM ₁₀ 0.1941 2.2468 0.0169 2.4478 0.0002 0.0000 0.2119 0.1060 0.0015 7.0221 0.1220 7.1456 9,7021 0.0163 0.0000 0.8247 5.4255 6.2665	Err PM2.5 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0165 0.0015 0.7022 1.1848 0.0163 0.0000 0.4948 0.5425 1.0853	VOCs VOCs 0.0142 0.0038 0.0181 0.0051 1.4/127 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.0118 15.9300 0.9470 0.0118 15.9300	Formaldehyde	Cons/well Benzene	Toluene	Xylene	Ethylbenzene	0.0000 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 738.9200 738.7634 24.0000 	CH ₄	N ₂ C
	otes: Construction emissions are based on ell pad construction. Source Type Veil Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Subtotal PRODUCTION TOTAL CONSTRUCTION AND	CO	NO _x	SO ₂	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.0015 7.0221 0.1220 7.1456 9.7021 0.0163 0.0000 0.8247 5.4255 6.2665	Err PM2.5 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0015 0.7022 1.1848 0.0163 0.00163 1.0537	VOCs VOCs 0.0142 0.0038 0.0181 0.025 0.4238 0.1978 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.0118 15.9300 0.9470 0.0118 15.9300 0.0118 15.9319	Formaldehyde	Cons/well	Toluene	Xylene	Ethylbenzene	0.0000 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.02498 0.2498 0.2499	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 738.7634 24.0000 	CH ₄ 0.0006 0.0001 0.0006 0.0001 0.0002 0.0355 0.0355 0.0355 0.0005 0.0005 0.0006 0.0006 0.0006 0.0006	N ₂ O 0.000 0.000 0.000 0.027 0.022 0.022 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0000 0.000 0.00000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0
	otes: Construction emissions are based on ell pad construction. Source Type Fell Pad Construction General Activity Vehicle Road Dust Equipment Exhaust Vehicle Exhaust Torilling Engines - Tier 4a (2011) Subtotal (with Tier 4a drilling) Ompletion and Testing Flaring Waste Pond Exaporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal CONSTRUCTION TOTAL Fell Production Heater/Treater Condensate Tanks Gas Generator Wind Blown Dust Vehicle Exhaust PRODUCTION TOTAL CONSTRUCTION AND PRODUCTION TOTAL.	CO	NO _x	SO ₂	PM ₁₀ 0.1841 2.2468 0.0169 2.4478 0.0027 0.0000 0.2119 0.1060 0.0311 0.0015 7.0221 0.1220 7.1456 9.7021 0.0163 0.0000 0.8247 5.4255 6.2665	Err PM2.5 0.0276 0.2247 0.0006 0.2529 0.0003 0.0000 0.2119 0.1060 0.0015 0.7022 1.1848 0.0163 0.00163 1.0537	VOCs VOCs 0.0142 0.0038 0.0181 0.025 0.4238 0.1978 0.4238 0.1978 0.0011 0.3500 0.0011 0.3500 0.0118 15.9300 0.9470 0.0118 15.9300 0.0118 15.9319	Formaldehyde	Cons/well	Toluene	Xylene	Ethylbenzene	0.0000 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.02498 0.2498 0.2499	11.7530 1.3527 13.1057 1.8434 736.9200 736.9200 738.7634 24.0000 3.3685 63.7560 27.3685 779.2375 257.6471 41.0975 4.2715 303.0161	CH ₄ 0.0006 0.0001 0.0006 0.0001 0.0002 0.0355 0.0355 0.0355 0.0005 0.0005 0.0006 0.0006 0.0006 0.0006	N ₂ C

Vehicle Road Dust							EWIIS	SION SUMMARY	2020							
No. Part P						Е	missions by	Source Categor	y (lbs/well)							
General Activity	Source Type	СО	NO _x	SO ₂	PM ₁₀	PM _{2.5}	VOCs	Formaldehyde	Benzene	Toluene	Xylene	Ethylbenzene	Hexane	CO ₂	CH ₄	N ₂ O
Vehicle Road Dust																
Equipment Exhaust	,				368.2	55.2								-		
Vehicle Exhaust					4493.6	449.4	-	-						-		
Neil Construction					33.8	1.2	28.5	0.17	0.13	0.06	0.04		-	23,506	1.13	0.70
Well Construction							7.6	0.02	0.02	0.0065	0.0045			2,705	0.12	0.08
Vehicle Road Dust		1 132.61	352.95	33.77	4,895.55	505.78	36.13	0.19	0.15	0.06	0.05	0.00	0.00	26,211.35	1.26	0.77
Vehicle Exhaust																
Drilling Engines - Tier 2					5.5	0.5		-				-	-			
Drilling Engines - Tier 4a (2011) 7,346.2 7,346.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,86.2 7,88.2 2 Completion and Testing Flaring 3.3.6 40.0 0.2 4 0.0 0.2 4 0.0 0.2 4 0.0 0.2 4 0.0 0.2 4 0.0 0.0 2 0.0 </td <td></td> <td></td> <td></td> <td></td> <td>0.0</td> <td>0.1</td> <td>10.3</td> <td>0.14</td> <td>0.09</td> <td>0.03</td> <td>0.02</td> <td></td> <td>-</td> <td>3,687</td> <td>0.34</td> <td>0.34</td>					0.0	0.1	10.3	0.14	0.09	0.03	0.02		-	3,687	0.34	0.34
Drilling Engines - Tier 4b (2015) Subtotal (with Tier 4b drilling) Completion and Testing Flaring Waste Pond Evaporation Vehicle Road Dust Vehicle Exhaust Frac Pump Engines Subtotal (Assert Construction Note) CONSTRUCTION AND PRODUCTION TOTAL CONSTRUCTION AND PRODUCTION TOTAL CONSTRUCTION TOTAL CONSTRUCTION AND PRODUCTION TOTAL CONSTRUCTION TOTAL CONSTRUCTION AND PRODUCTION TOTAL CONSTRUCTION CONSTRUCTION CONSTRUCTION CONSTRUCTION CONSTRUCTION AND CONSTRUCTION AND PRODUCTION TOTAL CONSTRUCTION CONSTRUCTIO					423.8	423.8 211.9	2,825.5 847.6	10.59	8.37 8.37	3.67	2.56		-	1,473,840 1,473,840	71.09 71.09	43.75
Subtotal (with Tier 4b drilling)					62.2	62.2	395.6	10.59	8.37	3.67	2.56		-	1,473,840	71.09	43.75
Dompletton and Testing Filaring 33.6 40.0 0.2					67.62	62.76	405.82	10.39	8.46	3.69	2.57	0.00	0.00	1,477,526.72	71.43	44.0
Flaring 33.6 40.0 0.2		7,393.41	7,360.60	70.02	67.62	02.76	405.62	10.73	0.40	3.09	2.51	0.00	0.00	1,477,320.72	71.43	44.0
Waste Pond Evaporation		22.6	40.0	0.2	3.0	3.0	2.2		0.00	0.00			1.81	48,000	0.92	0.88
Vehicle Road Dust					3.0	3.0	700.0	-	0.00	0.00			1.01	48,000	0.92	0.00
Vehicle Exhaust					14,044.3	1,404.4	700.0		-			-	-	-		
Table Tabl			25.7		14,044.3	1,404.4	19.0	0.07	0.06	0.02	0.01	-	-	6,737	0.34	0.24
Subtotal 845.48 3,503.00 227.58					242.0	242.0	278.8	0.92		0.32			-	127.512	28.31	0.24
CONSTRUCTION TOTAL 8,371.49					243.9 14.291.27	243.9 1,651.41	999.96	0.92	0.72 0.78	0.32	0.22 0.23	0.00	1.81	182.248.92	29.57	1.12
Moll Production												0.00				
Heater/Treater		6,3/1.49	11,210.54	340.17	19,254.43	2,219.94	1,441.92	11.91	9.39	4.10	2.85	0.00	1.81	1,685,986.99	102.26	45.9
Condensate Tanks	ater/Treater	360.7	420.4	26	32.6	32.6	23.6	0.32	0.01	0.01				515,294	9.88	9.45
Gas Generator		300.7	429.4	2.0	32.0	32.6		0.32	91.80	0.01		-	499.50	515,294	9.88	9.45
Wind Blown Dust		236.0	3 048 7	0.4	0.1	0.1	31,860.0	41.25	0.33	0.30	0.14	0.03	0.33	82,195		-
Vehicle Road Dust					1.649.3	989.6	-	41.25	0.33	0.30	0.14	0.03	0.33	82,195		
Vehicle Exhaust Subtotal 68.43 3,506.10 3.05	=				.,		-					-	-	-		
Subtotal 668.43 3,506.10 3,05		70.0	20.0		10,851.0	1,085.1	20.1	0.22	0.17	0.05	0.03		-	8.543	0.90	0.65
PRODUCTION TOTAL 668.43 3,506.10 3.05					12,532.99	2,107.38	31,903.76	41.78	92.31	0.05	0.03	0.03	499.83	606,032.24	10.78	10.10
CONSTRUCTION AND PRODUCTION TOTAL 9,039.92 14,722.65 343.22	PRODUCTION TOTAL	669.43			12,532.99	2,107.38	31,903.76	41.78	92.31	0.37	0.17	0.03	499.83	606,032.24	10.78	10.10
PRODUCTION TOTAL 9,039.92 14,722.65 343.22			3,300.10	3.03	12,332.99	2,107.36	31,903.76	41.70	92.31	0.37	0.17	0.03	499.03	000,032.24	10.76	10.10
Source Type																
Source Type	PRODUCTION TOTAL	9,039.92	14,722.65	343.22	31,787.42	4,327.32	33,345.67	53.69	101.70	4.47	3.03	0.03	501.64	2,292,019.24	113.04	56.09
Well Pad Construction						Er	nissions by S	Source Category	(tons/well)							
Veli Pad Construction	Source Type	СО	NO _x	SO ₂	PM ₁₀	PM _{2.5}	VOCs	Formaldehyde	Benzene	Toluene	Xylene	Ethylbenzene	Hexane	CO ₂	CH ₄	N ₂ C
Vehicle Road Dust		1														
Equipment Exhaust	eneral Activity				0.1841	0.0276										
Vehicle Exhaust 0.0139 0.0051 0.0000 Well Construction 0.0663 0.1765 0.0169 Well Construction 0.0663 0.1765 0.0169 Wehicle Road Dust					2.2468	0.2247		-						-		
Vehicle Exhaust 0.0139 0.0051 0.0000 Well Construction 0.0663 0.1765 0.0169 Well Construction 0.0663 0.1765 0.0169 Wehicle Road Dust	uipment Exhaust	0.0524	0.1713	0.0169	0.0169	0.0006	0.0142	0.0001	0.0001	0.0000	0.0000			11.7530	0.0006	0.000
Well Construction		0.0139					0.0038	0.0000	0.0000	0.0000	0.0000			1.3527	0.0001	0.000
Vehicle Road Dust	Subtota	0.0663	0.1765	0.0169	2.4478	0.2529	0.0181	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	13.1057	0.0006	0.000
Vehicle Exhaust	I Construction															
Drilling Engines - Tier 2 3,6731 5,3684 0,0394 Drilling Engines - Tier 4a (2011) 3,6731 3,6731 0,0394 Drilling Engines - Tier 4b (2015) 3,6731 3,6731 0,0394 Subbtoal (with Tier 4b drilling) 3,6967 3,6803 0,0394 Completion and Testing 0,0168 0,0200 0,0001 Flairing 0,0168 0,0200 0,0001 Waste Pond Evaporation - - - Vehicle Exhaust 0,0356 0,0129 0,0000 Frac Pump Engines 0,3703 1,7186 0,1137 Subtotal 0,4227 1,7515 0,1138 Well Production 0,1804 0,2147 0,013 Heater/Treater 0,1804 0,2147 0,001 Condensate Tanks - - - Gas Generator 0,1184 1,5243 0,0002 Wind Blown Dust - - - Vehicle Exhaust 0,0354 0,0140 0,0000 PRODUCTION TOTAL	hicle Road Dust				0.0027	0.0003		-						-		
Drilling Engines - Tier 4a (2011) 3.6731 3.6731 0.0394 Drilling Engines - Tier 4b (2015) 3.6731 3.6731 0.0394 Subtotal (with Tier 4b drilling) 3.6967 3.6803 0.0394 Completion and Testing Flaring 0.0168 0.0200 0.0001 Flaining 0.0168 0.0200 0.0001 Waste Pond Evaporation		0.0236	0.0072		0.0000	0.0000	0.0051	0.0001	0.0000	0.0000	0.0000			1.8434	0.0002	0.000
Drilling Engines - Tier 4a (2011) 3.6731 3.6731 0.0394 Drilling Engines - Tier 4b (2015) 3.6931 3.6731 0.0394 Subtotal (with Tier 4b drilling) 3.6967 3.6803 0.0394 Completion and Testing 0.0168 0.0200 0.0001 Flaring 0.0168 0.0200 0.0001 Waste Pond Evaporation	illing Engines - Tier 2				0.2119	0.2119	1.4127	0.0053	0.0042	0.0018	0.0013		-	736.9200	0.0355	0.021
Subtotal (with Tier 4b drilling) 3.6967 3.6803 0.0394	illing Engines - Tier 4a (2011)				0.1060	0.1060	0.4238	0.0053	0.0042	0.0018	0.0013		-	736.9200	0.0355	0.021
Completion and Testing Flaring 0.0168 0.0200 0.0001					0.0311	0.0311	0.1978	0.0053	0.0042	0.0018	0.0013	-	-	736.9200	0.0355	0.021
Flaring	Subtotal (with Tier 4b drilling	3.6967	3.6803	0.0394	0.0338	0.0314	0.2029	0.0054	0.0042	0.0018	0.0013	0.0000	0.0000	738.7634	0.0357	0.022
Waste Pond Evaporation																
Vehicle Road Dust		0.0168	0.0200	0.0001	0.0015	0.0015	0.0011		0.0000	0.0000			0.0009	24.0000	0.0005	0.000
Vehicle Exhaust Frac Pump Engines 0.0356 0.03703 0.0129 1.1786 0.0000 0.1137 Subtotal CONSTRUCTION TOTAL 4.1857 5.6083 0.1701 Nell Production Heater/Treator 0.1804 0.2147 0.0013 Gas Generator 0.1184 1.5243 0.0002 Wind Blown Dust Vehicle Road Dust - - - Vehicle Exhaust Subtotal 0.0354 0.0140 0.0000 0.0000 0.0015 PRODUCTION TOTAL 0.3342 0.3342 1.7531 1.7531 0.0015					-	-	0.3500	-	-	-			-	-		
0.3703 1.7186 0.1137					7.0221	0.7022		-						-		
Subtotal 0.4227 1.7515 0.1138							0.0095	0.0000	0.0000	0.0000	0.0000			3.3685	0.0002	0.000
CONSTRUCTION TOTAL 4.1857 5.6083 0.1701	ac Pump Engines				0.1220	0.1220	0.1394	0.0005	0.0004	0.0002	0.0001			63.7560	0.0142	
Well Production 0.1804 0.2147 0.0013 Heater/Treater 0.1804 0.2147 0.0013 Condensate Tanks - - - Gas Generator 0.1184 1.5243 0.0002 Wind Blown Dust - - - Vehicle Road Dust - - - - Vehicle Exhaust 0.0354 0.0140 0.0000 PRODUCTION TOTAL 0.3342 1.7531 0.0015					7.1456	0.8257	0.5000	0.0005	0.0004	0.0002	0.0001	0.0000	0.0009	91.1245	0.0148	0.000
Heater/Treater		4.1857	5.6083	0.1701	9.6272	1.1100	0.7210	0.0060	0.0047	0.0020	0.0014	0.0000	0.0009	842.9935	0.0511	0.023
Condensate Tanks - - - Gas Generator 0.1184 1.5243 0.0002 Wind Blown Dust - - - Vehicle Road Dust - - - - Vehicle Exhaust 0.0354 0.0140 0.0000 Vehicle Exhaust Subtotal 0.3342 1.7531 0.0015 PRODUCTION TOTAL 0.3342 1.7531 0.0015		0.1904	0.2447	0.0012	0.0163	0.0163	0.0118	0.0002	0.0000	0.0000				257.6471	0.0049	0.004
Gas Generator 0.1184 1.5243 0.0002 Wind Blown Dust Vehicle Road Dust 0.0354 0.0140 0.0000 Subtotal 0.3342 1.7531 0.0015 PRODUCTION TOTAL 0.3342 1.7531 0.0015		0.1804	0.2147	0.0013	0.0163	0.0163	15.9300	0.0002	0.0000	0.0000	-	-	0.2498	207.0471		
Wind Blown Dust		0.1104	1 5242	0.0002	0.0000	0.0000	15.9300	0.0206	0.0459	0.0002	0.0001	0.0000	0.2498	41.0975		
Vehicle Exhaust 0.0354 0.0140 0.0000 Subtotal 0.3342 1.7531 0.0015 PRODUCTION TOTAL 0.3342 1.7531 0.0015					0.0000	0.0000	-	0.0206	0.0002	0.0002	0.0001	0.0000	0.0002	41.09/5	-	
Vehicle Exhaust 0.0354 0.0140 0.0000 Subtotal 0.3342 1.7531 0.0015 PRODUCTION TOTAL 0.3342 1.7531 0.0015			+		5.4255	0.4948			-		-	-	-			
Subtotal 0.3342 1.7531 0.0015 PRODUCTION TOTAL 0.3342 1.7531 0.0015			0.0140		0.4200	0.0420	0.0101	0.0001	0.0001	0.0000	0.0000			4.2715	0.0004	0.000
PRODUCTION TOTAL 0.3342 1.7531 0.0015	HILDE EXHIDEST				6.2665	1.0537		0.0001	0.0001	0.0000	0.0000	0.0000	0.2499	4.2/15 303.0161	0.0004	0.000
	C	0.3342			6.2665	1.0537	15.9519 15.9519	0.0209	0.0462	0.0002	0.0001	0.0000	0.2499	303.0161	0.0054	0.005
	Subtota		1.7001	0.0015	0.2003	1.0557	10.9019	0.0209	0.0402	0.0002	0.0001	0.0000	0.2433	303.0101	0.0034	0.000
	PRODUCTION TOTA									0.0000	0.0015	0.0000	0.0500	1146.0096	0.0565	0.028
	PRODUCTION TOTAL CONSTRUCTION AND		7.3613	0.1716	15.8937	2.1637	16.6728	0.0268	0.0509							
Notes: Construction emissions are based on a per well constructed/drilled basis. C	PRODUCTION TOTAL CONSTRUCTION AND		7.3613	0.1716	15.8937	2.1637	16.6728	0.0268	0.0509	0.0022	0.0015	0.0000	0.2508	1146.0096	0.0303	

				CALF	UFF MODELII	IG - EMISSIO	N SUMMARY	(2028)							
<u>_</u>				E	missions by S	ource Categ	ory ^{1,2} (g/s/wel	l)							
O T	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}	VOCs			Ethylbenzene	Volume		Farmaldahada	CO ₂	CH₄	N ₂ O
Source Type Well Pad Construction ³	CO	NUx	302	PIVI ₁₀	PIVI _{2.5}	VUCS	Benzene	roluene	Ethylbenzene	Xylene	Hexane	Formaldehyde	CO ₂	СП4	N ₂ U
				0.0053	0.0008										
General Activity		-		0.0053	0.0065	-	-		-	-				-	
Vehicle Road Dust Equipment Exhaust	0.0015	0.0049	0.0005	0.0046	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000			0.3381	0.00002	0.0000
										0.0000					
Vehicle Exhaust	0.0004 0.0019	0.0001	0.0000	0.0704	0.0070	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0389	0.0000	0.0000
Subtotal	0.0019	0.0051	0.0005	0.0704	0.0073	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3770	0.0000	0.0000
Well Construction				0.0004	0.0000										
Vehicle Road Dust				0.0001	0.0000										
Vehicle Exhaust	0.0007	0.0002	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000			0.0530	0.0000	0.0000
Drilling Engines - Tier 2	0.1057	0.1544	0.0011	0.0061	0.0061	0.0406	0.0002	0.0001	0.0001	0.0000			21.1986	0.0010	0.0006
Drilling Engines - Tier 4a (2011)	0.1057	0.1057	0.0011	0.0030	0.0030	0.0122	0.0002	0.0001	0.0001	0.0000			21.1986	0.0010	0.0006
Drilling Engines - Tier 4b (2015)	0.1057	0.1057	0.0011	0.0009	0.0009	0.0057	0.0002	0.0001	0.0001	0.0000			21.1986	0.0010	0.0006
Subtotal (with Tier 4b drilling)	0.1063	0.1059	0.0011	0.0010	0.0009	0.0058	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	21.2516	0.0010	0.0006
Completion and Testing															
Flaring	0.0005	0.0006	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000			0.0000	0.6904	0.0000	0.0000
Waste Pond Evaporation		-		-		0.0101			-	-			-		
Vehicle Road Dust				0.2020	0.0202								-	-	
Vehicle Exhaust	0.0010	0.0004	0.0000			0.0003	0.0000	0.0000	0.0000	0.0000			0.0969	0.0000	0.0000
Frac Pump Engines	0.0107	0.0494	0.0033	0.0035	0.0035	0.0040	0.0000	0.0000	0.0000	0.0000			1.8340	0.0004	
Subtotal	0.0122	0.0504	0.0033	0.2056	0.0238	0.0144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.6213	0.0004	0.0000
CONSTRUCTION TOTAL	0.1204	0.1613	0.0049	0.2769	0.0319	0.0207	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000	24.2500	0.0015	0.0007
Well Production															
Heater/Treater	0.0052	0.0062	0.0000	0.0005	0.0005	0.0003	0.0000	0.0000	0.0000				7.4116	0.0001	0.0001
Condensate Tanks						0.4583		0.0013				0.0072		-	
Gas Generator	0.0034	0.0439	0.0000	0.0000	0.0000		0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	1.1822		
Wind Blown Dust				0.0237	0.0142								-	-	
Vehicle Road Dust				0.1561	0.0156										
Vehicle Exhaust	0.0010	0.0004	0.0000			0.0003	0.0000	0.0000	0.0000	0.0000			0.1229	0.0000	0.0000
Subtotal	0.0096	0.0504	0.0000	0.1803	0.0303	0.4589	0.0006	0.0013	0.0000	0.0000	0.0000	0.0072	8.7167	0.0002	0.0001
PRODUCTION TOTAL	0.0096	0.0504	0.0000	0.1803	0.0303	0.4589	0.0006	0.0013	0.0000	0.0000	0.0000	0.0072	8.7167	0.0002	0.0001
ONSTRUCTION AND PRODUCTION TOTAL	0.1300	0.2118	0.0049	0.4572	0.0622	0.4796	0.0008	0.0015	0.0001	0.0000	0.0000	0.0072	32.9667	0.0016	0.0008
Notes:															
Assumes emissions per well.				1											
² Emissions are spread over 8,760 hours per yea															
³ Construction emissions occur only in the year	that a well pad	is constructed ar	nd associated wel	Is are drilled. All	drilling is assu	med to be cor	npleted in the v	vear of well p	ad construction.						

	No of Wells	No of		Are	ea Source #2				Are	ea Source #2a	Area Source #2b						
	Constructed in	Producing	Dri	II Rig Engines (Construction)					ction of New W	ells			Producti	on of Exisit	ing Wells	
Alternative B (modeled year 2028)	2028	Wells in 2028	CO	NO _x	SO ₂	PM ₁₀ (PMC)	PM _{2.5} (PMF)	СО	NO _x	SO ₂	PM ₁₀	PM _{2.5}	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
Coolmont Minhenra	12	234	1.268E+00	1.268E+00	1.360E-02	1.073E-02	1.073E-02	1.770E-01	6.680E-01	4.511E-02	3.313E+00	3.724E-01	2.250E+00	1.180E+01	1.026E-02	4.218E+01	7.093E+00
Colvi	0	40	0.0	0.0	0.0	0.0	0.0	0.000E+00		0.000E+00		0.000E+00				7.211E+00	
Granby Anticline	0	16	0.0	0.0	0.0	0.0	0.0	0.000E+00		0.000E+00	0.000E+00		1.538E-01			2.884E+00	
McCallum and South McCallum Infill	2	40	2.113E-01	2.113E-01	2.267E-03	1.788E-03	1.788E-03	2.949E-02		7.518E-03		6.207E-02				7.211E+00	
Other North and Middle Park Field Infill	1	20	1.057E-01	1.057E-01	1.134E-03	8.941E-04	8.941E-04	1.475E-02		3.759E-03		3.104E-02				3.605E+00	
Rank Wildcats	1	20	1.057E-01	1.057E-01	1.134E-03	8.941E-04	8.941E-04	1.475E-02		3.759E-03		3.104E-02				3.605E+00	
TOTAL	16	370	1.69	1.69	0.02	0.01	0.01	0.24	0.89	0.06	4.42	0.50	3.56	18.66	0.02	66.70	11.22
Alternative B (modeled year 2028)					ea Source #1												
			Construction	of New Wells a													
Coalmont Niobrara (CN)	12	234	2.427E+00	1.247E+01	5.537E-02		7.465E+00										
CBM (CBMa, CBMb, CBMc)	0	40		2.017E+00	1.754E-03	7.211E+00											
СВМа				9.075E-01	7.892E-04	3.244E+00	5.455E-01	CBM a	329,051,182.82	45.0%							
CBMb				5.402E-01	4.698E-04	1.931E+00	3.247E-01	CBM b	195,874,382.75	26.8%							
CBMc				5.695E-01	4.952E-04	2.036E+00	3.423E-01	СВМ с	206,478,165.68	28.2%							
Granby Anticline (GA)	0	16	1.538E-01	8.069E-01	7.016E-04	2.884E+00	4.850E-01										
McCallum and South McCallum Infill (MC)	2	40	4.141E-01	2.129E+00	9.272E-03	7.763E+00	1.275E+00										
Other North and Middle Park Field Infill (OTH)	1	20	2.070E-01	1.064E+00	4.636E-03	3.881E+00	6.373E-01										
Rank Wildcats (RW)	1	20	2.070E-01	1.064E+00	4.636E-03	3.881E+00	6.373E-01										
TOTAL	16	370	3.79	21.57	0.08	78.33	12.92										
GRAND TOTAL (g/s)			5.48	23.26	0.10	78.34	12.94										
GRAND TOTAL (tpy)			190.63	808.48	3.35	2723.30	449.77										
	Alternative B (m	odeled year 20	028)														
			Area So	ource #1													
		Constructi	on of New Well	s and Productio	n of Wells												
			Emission	s (g/s/m2)													
Location	area (m2)	SO ₂	NO _x	PM ₁₀ (PMC)	PM _{2.5} (PMF	5											
Coalmont Niobrara	423.951.805	1.306E-10	2.941E-08	1.073E-07	1.761E-08	1											
Granby Anticline	232,221,270	3.021E-12	3.475E-09	1.242E-08	2.088E-09	1											
McCallum and South McCallum Infill	426,037,728	2.176E-11	4.996E-09	1.822E-08	2.992E-09	1											
Other North and Middle Park Field Infill	253,604,956	1.828E-11	4.196E-09	1.530E-08	2.513E-09												
Rank Wildcats	232,221,270	1.996E-11	4.583E-09	1.671E-08	2.744E-09	1											
CBMa	329,051,182.82	2.398E-12	2.758E-09	9.859E-09	1.658E-09												
CBMb	195,874,382.75	2.398E-12	2.758E-09	9.859E-09	1.658E-09	<u> </u>											
CBMc	206,478,165.68	2.398E-12	2.758E-09	9.859E-09	1.658E-09	i											
OBINO	200, 170, 100.00	2.0002 12		ource #2	1.0002 00	1											
		Drill Ria E	Engines (Constru		s (a/s/m2)	1											
Coalmont Niobrara (CN)	423,951,805	3,209E-11	2.991E-09	2.531E-11	2.531E-11	1											
Granby Anticline (GA)	232,221,270	0	0	0	0	i i											
McCallum and South McCallum Infill (MC)	426,037,728	5.322E-12	4.960E-10	4.197E-12	4.197E-12	1											
Other North and Middle Park Field Infill (OTH)	253,604,956	4.470E-12	4.166E-10	3.525E-12	3.525E-12	i e											
Rank Wildcats (RW)	232,221,270	4.882E-12	4.550E-10	3.850E-12	3.850E-12												
CBM (CBMa, CBMb, CBMc)	731,403,731	0	0	0	0	1											
(a, obino, obino,	701, 100,701	- J	,		Ţ,												
	No of Wells	No of	İ														
	Constructed in	Producing															
Alternative A	2028	Wells in 2028															
Coalmont Niobrara	0	7															
CBM	0	0															
Granby Anticline	0	0															
McCallum and South McCallum Infill	0	84			-												
Other North and Middle Park Field Infill	0	04	-														
Rank Wildcats	0	17	l														
TOTAL	0	109	-														
IVIAL	U	109	l														

Table 5.24 ALTERNATIVE B - TOTAL EN	IISSIONS	BY YEAR																		
Wells to be Drilled Annually		DI ILAN																		
Year	1 2009	2 2010	3 2011	4 2012	5 2013	6 2014	7 2015	8 2016	9 2017	10 2018	11 2019	12 2020	13 2021	14 2022	15 2023	16 2024	17 2025	18 2026	19 2027	20 2028
Wells Drilled Per Year Total Producing Wells	14 14	14 28	14 42	14 56	28 84	17 101	17 118	17 135	31 166	16 182	16 198	16 214	30 244	16 260	16 276	16 292	30 322	16 338	16 354	16 370
Estimated Construction Emis	ssions (ton	s/yr) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Tier 2 Drill Rig Engines (%)	2009 100%	2010 100%	2011 0%	2012 0%	2013 0%	2014 0%	2015 0%	2016 0%	2017 0%	2018 0%	2019 0%	2020 0%	2021 0%	2022 0%	2023 0%	2024 0%	2025 0%	2026 0%	2027 0%	2028 0%
Tier 4a Drill Rig Engines (%) Tier 4b Drill Rig Engines (%)	0% 0%	0% 0%	100% 0%	100% 0%	100% 0%	100% 0%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%	0% 100%
CO NOx	59 102	59 102	59 79	59 79	117 157	71 95	71 95	71 95	130 174	67 90	67 90	67 90	126 168	67 90	67 90	67 90	126 168	67 90	67 90	6
SO2 PM10	2 137	2 137	2 136	2 136	5 272	3 165	3 164	3 164	5 298	3 154	3 154	3 154	5 289	3 154	3 154	3 154	5 289	3 154	3 154	15
PM2.5	18	18	17	17	33	20	19	19	34	18	18	18	33	18	18	18	33	18	18	15
VOC	27	27	13	13	27	16	12	12	22	12	12	12	22	12	12	12	22	12	12	1:
Formaldehyde Benzene	0.08	0.08	0.08 0.06	0.08	0.15 0.12	0.09	0.10	0.10	0.18 0.15	0.10	0.10	0.10	0.18 0.14	0.10	0.10 0.08	0.10	0.18 0.14	0.10	0.10	0.10
Toluene	0.03	0.08	0.08	0.08	0.12	0.03	0.03	0.08	0.15	0.03	0.03	0.08	0.14	0.08	0.08	0.08	0.14	0.08	0.08	0.0
Xylene	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.0
Ethylbenzene Hexane	0.00	0.00	0.00 0.01	0.00 0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Total HAPs	0.20	0.20	0.20	0.20	0.39	0.02	0.26	0.26	0.47	0.24	0.24	0.24	0.45	0.24	0.24	0.24	0.45	0.24	0.24	0.2
CO2	10,909	10,909	10,909	10,909	21,819	13,247	14,331	14,331	26,133	13,488	13,488	13,488	25,290	13,488	13,488	13,488	25,290	13,488	13,488	13,48
CH4 N2O	0.32	0.32	0.32	0.32	0.64	0.39	0.39	0.39	0.71	0.37	0.37	0.37	0.69	0.37	0.37	0.37	0.69	0.37	0.37	0.3
Estimated Production Emiss	ione (tone	(vr)																		
Year	1 2009	2 2010	3 2011	4 2012	5 2013	6 2014	7 2015	8 2016	9 2017	10 2018	11 2019	12 2020	13 2021	14 2022	15 2023	16 2024	17 2025	18 2026	19 2027	20 2028
CO NOx	5 25	9	14 74	19 98	28 147	34 177	39 207	45 237	55 291	61 319	66 347	72 375	82 428	87 456	92 484	98 512	108 564	113 593	118 621	12- 64
SO2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	04
PM10	88	175	263	351	526	633	739	846	1,040	1,141	1,241	1,341	1,529	1,629	1,730	1,830	2,018	2,118	2,218	2,31
PM2.5 VOC	15 223	30 447	44 670	59 893	1.340	106 1,611	124 1.882	142 2.154	175 2,648	192 2.903	209 3,158	225 3.414	257 3.892	274 4,147	291 4.403	308 4,658	339 5,137	356 5.392	373 5,647	5,90
Formaldehyde	0.29	0.58	0.88	1.17	1.75	2.11	2.47	2,134	3.47	3.80	4.14	4.47	5.10	5.43	5.77	6.10	6.73	7.06	7.40	7.7
Benzene	0.65	1.29	1.94	2.58	3.88	4.66	5.45	6.23	7.66	8.40	9.14	9.88	11.26	12.00	12.74	13.48	14.86	15.60	16.34	17.0
Toluene Xylene	0.00	0.01	0.01 0.00	0.01 0.00	0.02	0.02	0.02	0.02 0.01	0.03	0.03	0.04	0.04	0.04	0.05	0.05 0.02	0.05	0.06	0.06	0.07	0.0
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.03	0.03	0.0
Hexane	3.50	7.00	10.50	14.00	20.99	25.24	29.49	33.74	41.49	45.48	49.48	53.48	60.98	64.98	68.98	72.98	80.47	84.47	88.47	92.4
Total HAPs CO2	4.44 4,242	8.88 8,484	13.32 12,727	17.77 16,969	26.65	32.04	37.44	42.83	52.66	57.74 55,149	62.82	67.89	77.41 73,936	82.48 78,784	87.56	92.64	102.15 97,571	107.23 102,419	112.31 107,268	117.3
CH4	0.08	0.15	0.23	0.30	25,453 0.45	30,605 0.54	35,756 0.64	40,907 0.73	50,301 0.89	0.98	59,997 1.07	64,845 1.15	1.31	1.40	83,632 1.49	88,481 1.57	1.73	1.82	1.91	1.9
N2O	0.07	0.14	0.04																4 70	
		0.11	0.21	0.28	0.42	0.51	0.60	0.68	0.84	0.92	1.00	1.08	1.23	1.31	1.39	1.47	1.63	1.71	1.79	1.8
Estimated Total Emissions (t	tons/yr)																			
Year	tons/yr) 1 2009	2 2010	3 2011	4 2012	5 2013	6 2014	7 2015	8 2016	9 2017	10 2018	11 2019	12 2020	13 2021	14 2022	15 2023	16 2024	17 2025	18 2026	19 2027	20 2028
Year	1 2009 63	2 2010 68	3 2011 73	4 2012 77	5 2013 145	6 2014 105	7 2015 111	8 2016 116	9 2017 185	10 2018 128	11 2019 133	12 2020 138	13 2021 207	14 2022 154	15 2023 159	16 2024 165	17 2025 233	18 2026 180	19 2027 185	20 2028 19
Year CO NOx	1 2009 63 127	2 2010 68 151	3 2011	4 2012 77 177	5 2013 145 304	6 2014 105 272	7 2015 111 302	8 2016 116 332	9 2017 185 465	10 2018	11 2019 133 437	12 2020 138 465	13 2021 207 596	14 2022 154 546	15 2023	16 2024 165 602	17 2025 233 733	18 2026 180 682	19 2027 185 710	20 2028
Year	1 2009 63	2 2010 68	3 2011 73 152 2 399	4 2012 77	5 2013 145	6 2014 105	7 2015 111	8 2016 116	9 2017 185	10 2018 128 409	11 2019 133	12 2020 138	13 2021 207	14 2022 154	15 2023 159 574	16 2024 165	17 2025 233	18 2026 180	19 2027 185	20 2028 19
Year CO NOx SO2 PM10 PM10 PM2.5	1 2009 63 127 2 225 33	2 2010 68 151 2 313 48	3 2011 73 152 2 399 61	4 2012 77 177 2 487 76	5 2013 145 304 5 798 122	6 2014 105 272 3 798 127	7 2015 111 302 3 903 143	8 2016 116 332 3 1,010 161	9 2017 185 465 6 1,339 209	10 2018 128 409 3 1,295 210	11 2019 133 437 3 1,395 226	12 2020 138 465 3 1,495 243	13 2021 207 596 5 1,818 290	14 2022 154 546 3 1,783 292	15 2023 159 574 3 1,884 309	16 2024 165 602 3 1,984 325	17 2025 233 733 6 2,307 373	18 2026 180 682 3 2,272 374	19 2027 185 710 3 2,372 391	20 2028 19 73: : 2,47:
Year CO NOx SO2 PM10 PM2.5 VOC	1 2009 63 127 2 225 33 250	2 2010 68 151 2 313 48 474	3 2011 73 152 2 399 61 683	4 2012 77 177 2 487 76 907	5 2013 145 304 5 798 122 1,366	6 2014 105 272 3 798 127 1,627	7 2015 111 302 3 903 143 1,895	8 2016 116 332 3 1,010 161 2,166	9 2017 185 465 6 1,339 209 2,670	10 2018 128 409 3 1,295 210 2,915	11 2019 133 437 3 1,395 226 3,170	12 2020 138 465 3 1,495 243 3,425	13 2021 207 596 5 1,818 290 3,914	14 2022 154 546 3 1,783 292 4,159	15 2023 159 574 3 1,884 309 4,414	16 2024 165 602 3 1,984 325 4,669	17 2025 233 733 6 2,307 373 5,158	18 2026 180 682 3 2,272 374 5,403	19 2027 185 710 3 2,372 391 5,659	20 2028 19 73i : 2,47: 40i 5,91-
Year CO NOx SO2 PM10 PM10 PM2.5	1 2009 63 127 2 225 33	2 2010 68 151 2 313 48	3 2011 73 152 2 399 61	4 2012 77 177 2 487 76	5 2013 145 304 5 798 122	6 2014 105 272 3 798 127	7 2015 111 302 3 903 143	8 2016 116 332 3 1,010 161	9 2017 185 465 6 1,339 209	10 2018 128 409 3 1,295 210	11 2019 133 437 3 1,395 226	12 2020 138 465 3 1,495 243	13 2021 207 596 5 1,818 290	14 2022 154 546 3 1,783 292	15 2023 159 574 3 1,884 309	16 2024 165 602 3 1,984 325	17 2025 233 733 6 2,307 373	18 2026 180 682 3 2,272 374	19 2027 185 710 3 2,372 391	20 2028 19 73: : 2,47:
Year CO NOX SO2 PM10 PM2.5 VOC Formaldehyde Benzene Toluene	1 2009 63 127 2 225 33 250 0.37 0.71 0.03	2 2010 68 151 2 313 48 474 0.66 1.35 0.03	3 2011 73 152 2 399 61 683 0.95 2.00 0.03	4 2012 77 177 2 487 76 907 1.25 2.65 0.04	5 2013 145 304 5 798 122 1,366 1.91 4.00 0.07	6 2014 105 272 3 798 127 1,627 2.20 4.74 0.05	7 2015 111 302 3 903 143 1,895 2.57 5.53 0.06	8 2016 116 332 3 1,010 161 2,166 2.92 6.31 0.06	9 2017 185 465 6 1,339 209 2,670 3.65 7.81 0.09	10 2018 128 409 3 1,295 210 2,915 3.90 8.48 0.07	11 2019 133 437 3 1,395 226 3,170 4.23 9.21 0.07	12 2020 138 465 3 1,495 243 3,425 4.57 9.95 0.07	13 2021 207 596 5 1,818 290 3,914 5.28 11.40 0.11	14 2022 154 546 3 1,783 292 4,159 5.53 12.08 0.08	15 2023 159 574 3 1,884 309 4,414 5.86 12.81 0.08	16 2024 165 602 3 1,984 325 4,669 6.20 13.55 0.09	17 2025 233 733 6 2,307 373 5,158 6.91 15.00 0.12	18 2026 180 682 3 2,272 374 5,403 7.16 15.68 0.09	19 2027 185 710 3 2,372 391 5,659 7.49 16.41 0.10	20 2028 19 73: : 2,47: 40: 5,91: 7.8: 17.1:
Year CO NOx SO2 PM10 PM2.5 VOC Formaldehyde Benzene Toluene Xylene	1 2009 63 127 2 225 33 250 0.37 0.71 0.03 0.02	2 2010 68 151 2 313 48 474 0.66 1.35 0.03 0.02	3 2011 73 152 2 399 61 683 0.95 2.00 0.03 0.02	4 2012 77 177 2 487 76 907 1.25 2.65 0.04 0.02	5 2013 145 304 5 798 122 1,366 1,91 4.00 0.07 0.04	6 2014 105 272 3 798 127 1,627 2.20 4.74 0.05 0.03	7 2015 111 302 3 903 143 1,895 2.57 5.53 0.06 0.03	8 2016 116 332 3 1,010 161 2,166 2,92 6.31 0.06 0.04	9 2017 185 465 6 1,339 209 2,670 3.65 7.81 0.09 0.06	10 2018 128 409 3 1,295 210 2,915 3,90 8.48 0.07 0.04	11 2019 133 437 3 1,395 226 3,170 4.23 9.21 0.07 0.04	12 2020 138 465 3 1,495 243 3,425 4.57 9.95 0.07 0.04	13 2021 207 596 5 1,818 290 3,914 5.28 11.40 0.11 0.06	14 2022 154 546 3 1,783 292 4,159 5,53 12.08 0.08 0.05	15 2023 159 574 3 1,884 309 4,414 5.86 12.81 0.08 0.05	16 2024 165 602 3 1,984 325 4,669 6.20 13.55 0.09 0.05	17 2025 233 733 6 2,307 373 5,158 6,91 15.00 0.12 0.07	18 2026 180 682 3 2,272 374 5,403 7.16 15.68 0.09 0.05	19 2027 185 710 3 2,372 391 5,659 7.49 16.41 0.10 0.05	20 2028 19 73: 2,47: 40: 5,91- 7.8: 17.1: 0.1: 0.0:
Year CO NOX SO2 PM10 PM2.5 VOC Formaldehyde Benzene Toluene	1 2009 63 127 2 225 33 250 0.37 0.71 0.03	2 2010 68 151 2 313 48 474 0.66 1.35 0.03	3 2011 73 152 2 399 61 683 0.95 2.00 0.03	4 2012 77 177 2 487 76 907 1.25 2.65 0.04	5 2013 145 304 5 798 122 1,366 1.91 4.00 0.07	6 2014 105 272 3 798 127 1,627 2.20 4.74 0.05	7 2015 111 302 3 903 143 1,895 2.57 5.53 0.06	8 2016 116 332 3 1,010 161 2,166 2.92 6.31 0.06	9 2017 185 465 6 1,339 209 2,670 3.65 7.81 0.09	10 2018 128 409 3 1,295 210 2,915 3.90 8.48 0.07	11 2019 133 437 3 1,395 226 3,170 4.23 9.21 0.07	12 2020 138 465 3 1,495 243 3,425 4.57 9.95 0.07	13 2021 207 596 5 1,818 290 3,914 5.28 11.40 0.11	14 2022 154 546 3 1,783 292 4,159 5.53 12.08 0.08	15 2023 159 574 3 1,884 309 4,414 5.86 12.81 0.08	16 2024 165 602 3 1,984 325 4,669 6.20 13.55 0.09	17 2025 233 733 6 2,307 373 5,158 6.91 15.00 0.12	18 2026 180 682 3 2,272 374 5,403 7.16 15.68 0.09	19 2027 185 710 3 2,372 391 5,659 7.49 16.41 0.10	20 2028 19 73: : 2,47: 40: 5,91: 7.8: 17.1:
Year CO NOX SO2 PM10 PM2.5 VOC Formaldehyde Benzene Toluene Xylene Ethylbenzene	1 2009 63 127 2 225 33 250 0.37 0.71 0.03 0.02 0.00	2 2010 68 151 2 313 48 474 0.66 1.35 0.03 0.02 0.00	3 2011 73 152 2 399 61 683 0.95 2.00 0.03 0.02 0.00	4 2012 77 177 2 487 76 907 1.25 2.65 0.04 0.02 0.00	5 2013 145 304 5 798 122 1,366 1,91 4.00 0.07 0.04 0.00	6 2014 105 272 3 798 127 1,627 2,20 4,74 0.05 0.03 0.00	7 2015 111 302 3 903 143 1,895 2.57 5.53 0.06 0.03 0.00	8 2016 116 332 3 1,010 161 2,166 2.92 6.31 0.06 0.04 0.00	9 2017 185 465 6 1,339 209 2,670 3.65 7.81 0.09 0.06 0.00	10 2018 128 409 3 1,295 210 2,915 3,90 8,48 0.07 0.04 0.00	11 2019 133 437 3 1,395 226 3,170 4.23 9.21 0.07 0.04 0.00	12 2020 138 465 3 1,495 243 3,425 4.57 9.95 0.07 0.04	13 2021 207 596 5 1,818 290 3,914 5.28 11.40 0.11 0.06 0.00	14 2022 154 546 3 1,783 292 4,159 5.53 12.08 0.08 0.05 0.00	15 2023 159 574 3 1,884 309 4,414 5.86 12.81 0.08 0.05 0.05	16 2024 165 602 3 1,984 325 4,669 6.20 13.55 0.09 0.05	17 2025 233 733 6 2,307 373 5,158 6,91 15.00 0.12 0.07 0.00	18 2026 180 682 3 2,272 374 5,403 7.16 15.68 0.09 0.05 0.01	19 2027 185 710 3 2,372 391 5,659 7.49 16.41 0.10 0.05 0.01	20 2028 19 733 2,477 400 5,91- 7.88 17.11 0.01 0.00
Year CO NOX SO2 PM10 PM2.5 VOC Formaldehyde Benzene Toluene Xylene Ethylbenzene Hexane	1 2009 63 127 2 225 33 250 0.37 0.71 0.03 0.02 0.00 3.51	2 2010 68 151 2 313 48 474 0.66 1.35 0.03 0.02 0.00 7.01	3 2011 73 152 2 399 61 683 0.95 2.00 0.03 0.02 0.00 0.00	4 2012 77 177 2 487 76 907 1.25 2.65 0.04 0.02 0.00 14.01	5 2013 145 304 5 798 122 1,366 1.91 4.00 0.07 0.04 0.00 21.02	6 2014 105 272 3 798 127 1,627 2,20 4,74 0.05 0.03 0.00 25,26	7 2015 111 302 3 903 143 1,895 2,57 5,53 0,06 0,03 0,00 29,51	8 2016 116 332 3 1,010 161 2,166 2.92 6.31 0.06 0.04 0.00 33.75	9 2017 185 465 6 1,339 209 2,670 3,655 7,81 0.09 0.06 0.00	10 2018 128 409 3 1,295 210 2,915 3,90 8,48 0.07 0.04 0.00 45,50	11 2019 133 437 3 1,395 226 3,170 4,23 9,21 0,07 0,04 0,00 49,50	12 2020 138 465 3 1,495 243 3,425 4,57 9,95 0,07 0,04 0,00 53,50	13 2021 207 596 5 1,818 290 3,914 5,228 11.40 0.11 0.06 0.00 0.00 61.01	14 2022 154 546 3 1,783 292 4,159 5,53 12.08 0.08 0.05 0.00 64.99	15 2023 159 574 3 1,884 309 4,414 5.86 12.81 0.08 0.05 0.00 68.99	16 2024 165 602 3 1,984 325 4,669 6.20 13.55 0.09 0.05 0.00 72.99	17 2025 233 733 6 2,307 373 5,158 6,91 15.00 0.12 0.07 0.00 80.50	18 2026 180 682 3 2,272 374 5,403 7,16 15,68 0.09 0.05 0.01 84,49	19 2027 185 710 3 2,372 391 5,659 7,49 16.41 0.10 0.05 0.01 88.48	20 2028 19 733 2,447 406 5,91 7.83 17.11 0.01 0.00 92.44



Volume Three

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